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Fine Attendance at Thursday's Session

R. H. Aishton's address, unavoidably postponed from the Wednesday session, was presented by Mr. Aishton in person on Thursday morning and proved to be well worth waiting for. This address, in combination with the unusually high-grade papers presented Thursday, was sufficient to bring out a record attendance. Practically every seat in the Greek Temple was taken, and some of the members were compelled to stand in the rear and around the sides of the room. If this interest continues, as an examination of the program of future sessions gives every promise that it will, arrangements must be made to provide more seating space. In spite of the fact that the Division remained in session well past the announced closing time, few of the members left the room, and this sustained interest was the finest kind of a compliment to the papers and their authors. It was also a compliment to the members of the Mechanical Division, for it shows that they appreciate and are determined to profit to the utmost by the constructive program of reports and papers prepared for them.

Mr. Aishton's Inspiring Address

No man in the United States is doing a greater work for the railways than R. H. Aishton, president of the American Railway Association. Among other activities he is occasionally delivering addresses at meetings of the various divisions of the association and the inspiring address he delivered yesterday is a fine example of the kind of addresses that produce results. He commended the railways for the initiative being shown by them individually in improving their facilities and operations, and for the splendid way in which they have co-operated recently in carrying out their program to provide the public with sufficient and economical transportation. He urged them to continue to make progress on the lines that they have been following. He pointed out that one of the great questions before the American people is, "Are the railroads being efficiently and economically operated?" and that upon the answer public sentiment makes to the latter question depends the future of the railroads. Such views cannot be reiterated too often before meetings of railway officers and when they are expressed by a man of Mr. Aishton's position, ability and experience, they are bound to exert a great influence. Anybody who reviews what has occurred in the railway field within the last four years must be deeply impressed with the fact that the carriers since they were returned to private operation have made a long advance. They have greatly improved the service rendered, largely reduced operating costs, and at the same time converted a large deficit which was then being incurred to a large net return which is now being earned. The net return being earned at present is not satisfactory, but it is a great improvement over any net return earned between 1917 and 1923. If the railways individually continue to handle all their affairs as well and if they continue to co-operate with each other as well during the next three years as they have during the last three years, it seems safe to predict that the railway situation as a whole will be more satisfactory three years ahead than it has been since the Hepburn Act went into effect in 1906.

Brains and Machinery

If the buyer of machine tools would take the time to consider just what the tool he is purchasing represents, he would find it to be more than a foundry and machine shop product. That a mass of iron and steel cannot be made into a machine without first being organized in the mind of the designer is a familiar concept, and the most important factor entering into a machine is, after all, brains. The manufacturer, in order to sell, must employ the brains necessary to design and improve his product, and the brains and man power necessary to maintain an organization to sell and to serve the customer. It is evident that brains

cannot be removed from the machine. The question of cost is a vital one, because the volume of sales depends on the ability to reduce costs to a par with or below competitor's prices. Any sound method of eliminating engineering research, sales or service expense, would be welcomed by the maker of machine tools. The money the customer pays for the tool includes a proportionate cost for engineering and service expense, and the manufacturer must apportion a share of the cost to each of these departments. It is, therefore, the business of the buyer to see that he gets all that he pays for and utilizes the engineering and service departments that are maintained for his benefit. In the final analysis, the entire question comes down to how much iron and how much brains the customer buys. Pig iron can be bought for so much a pound, but when it is converted into a casting or machine tool, the cost of brains must be added to the cost of material. The application of modern machine tools in railroad shops depends largely on the brains that can be applied to development work. When the brains, which are represented by the manufacturer's engineering and service departments, are not utilized, the buyer is the loser. A policy of co-operation between the railroad shop and the manufacturer will be of mutual advantage and both parties should obtain more satisfactory results from the standpoint of machine tool production.

An Exemplary Performance

Something more than 100 were included in the attendance at the meeting of the Association of Railway Electrical Engineers yesterday. This represents about the maximum number which can be accommodated in the meeting room which has been used for a number of years; if the activities of the association continue to increase more space will have to be provided for future meetings. A decidedly business-like meeting was held and no time was wasted in irrelevant discussion. Thirteen progress reports were presented and discussed, and plans were made for activities at the annual meeting, to be held at Chicago in October. The meeting was adjourned at two o'clock. The association is to be congratulated on the way it has selected and is handling the many pertinent questions of the present time.

Do Not Forget the Track Exhibits

One of the really important features of these conventions, which is oftentimes missed by far too many of those attending, is the track exhibits. Mississippi Avenue is only a short walk down the Boardwalk, and an inspection of the cars and locomotives there displayed will well repay the small effort involved. For those interested in locomotives there is the three-cylinder Lehigh Valley locomotive, No. 5000, which was the subject of yesterday's paper by Mr. Blunt, of the American Locomotive Company; a Reading locomotive of the Pacific type, right from the Baldwin Locomotive works; a D. & H. Consolidation locomotive equipped with an M. & L. tender booster, and a C. M. & St. P. electric locomotive, built by the General Electric Company. For motor cars, there are the Brill Model 55 and the Sykes two-car train. Freight cars shown include a N. & W. and a Reading gondola, both of 70 tons capacity: also a Clark dump car. By taking a bus to North Providence Terrace, about four blocks west of the Boardwalk, one may inspect the two new electric locomotives of the Pennsylvania Railroad. Not the least important part of the exhibits are the new standard box cars, exhibited on Georgia Avenue by the Pennsylvania Railroad, showing in wood and steel just what the Car Construction Committee has accomplished. Near them will be found a Nickel Plate dynamometer car equipped by the Burr Company and also a small test car. As a whole, this is, perhaps, one of the most important and instructive track exhibits ever assembled at any Atlantic City convention.

Co-Operate With the Enginemen

In his address yesterday morning R. H. Aishton, president of the American Railway Association, repeated a suggestion which he made before the International Railway Fuel Association convention, that a goal of one pound of fuel less per 1000 gross ton-miles, or the equivalent unit of switching or passenger service, be established on all American railroads. In repeating this suggestion he urged the Mechanical Division members to assist actively in the attainment of this goal. There are many opportunities for mechanical department officers to participate in this tremendously important accomplishment. One of these is found in the close co-operation which they can render to the men operating the locomotives in giving sympathetic attention to the maintenance of all the parts of the locomotive influencing the efficiency of combustion. To a large extent, it is true, the ability of the mechanical department to render such co-operation depends on receiving legible and intelligent work reports. But even in this matter, the mechanical department can help itself tremendously by a persistent campaign of instruction and suggestion, accompanied by an attitude which indicates to the men real sympathy with their desire for locomotives from which they can, with reasonable assurance, expect to attain some results for their efforts to promote economy. Nothing is more effective in promoting the enthusiastic support of the firemen and enginemen in saving coal than to furnish them with highly effective tools to work with.

Utilize Outside Talent on Committees

Why does not the Mechanical Division make a larger use of non-railroad men on its committees? This is not a new question, but it has never been satisfactorily answered. There is a remarkable amount of expert mechanical engineering talent outside of the railroads, but particularly interested in railway mechanical problems, which could be utilized to splendid advantage on the committees. The line between railroad men and these experts, however, is drawn almost as clearly and strongly as if the Mechanical Division committee work was quarantined against a terrible disease to which these outsiders might expose it. Incidentally, the outsiders are not voicing any complaint, although we frequently hear it said that these men, often with a remarkable grasp of certain phases of railway mechanical engineering, have no standing in the railroad associations, except for the railroad clubs and the Railroad Section of the American Society of Mechanical Engineers. This is unfortunate, because they are in a position to make a real contribution to the research and committee work of the Division. It is doubtful if any railroad engineering organization has higher ethics and ideals than the American Railway Engineering Association. It is sometimes desig-

nated as a "high brow" organization. And yet, it includes in the membership of its committees (in addition to college professors which the Mechanical Division also recognizes) consulting engineers, representatives of government bureaus, engineers in the railway supply and allied industries, and editors of railway and engineering periodicals. There is no evidence that this detracts from the dignity of the association; there are many evidences that it does add to the technical value of the reports and proceedings.

More Miles Between Locomotive Terminals

The steam locomotive has long been an effective instrument of transportation. During the past two decades great strides have been made in improving the efficiency with which it does its work. Little attention, however, was given to the amount of work actually obtained from each locomotive in the course of a given period, except during the periods of peak traffic. During these periods pooling of power was the stock method of affecting increased utilization, with little regard to its ultimate effect on the condition of the locomotives, and pooling thus came to be an established institution on many roads. Its merits are, however, still a matter of controversy. There are many mechanical officers and some operating officers who believe that better results may be obtained with assigned engines, when the time lost through reduced mileage between detentions for heavy running and classified repairs and the loss through the ineffective use of labor in trying to follow up indifferent work reports, are taken into consideration.

Whatever the merits of this question may be—the answer will probably depend on many local conditions, such as character of facilities, nature of traffic fluctuation, etc.—it is becoming increasingly evident that there is need for more utilization in hours and miles per day of these modern traveling power plants, which represent an investment of $40,000 to $60,000 each.

There is no one method by which the maximum service can ultimately be obtained. Many conditions are involved. Terminal facilities must be adequate and properly arranged, the transportation department must not fool away the time of the locomotive in the terminal before getting the train started on the road, and the locomotive must not be left in the hands of the mechanical department any longer than necessary. Probably the most effective means of cutting down the proportion of the total locomotive day in the hands of the mechanical department, particularly in passenger service, is to increase the length of the locomotive run to the fullest extent which other conditions will permit. This has been done effectively on a number of roads and the number of long runs is constantly increasing, not only in oil burning territory but in coal burning territory as well. The time required in the hands of the mechanical department after a run of 500 miles is very little greater than that required after a run of 100 miles. In freight service the turn-around run, where conditions will permit both the locomotive and the crew to double the division within the law, is more generally possible than extending the run over more than one division. Here the possibility of returning to the home terminal without the necessity of a layover away from home offers an inducement for the crew to get over the road with a minimum of delay for which they are responsible, which generally is very much lacking in American railroad service.

Today's Program

The meeting of Division V, Mechanical, American Railway Association, will be held in the Greek Temple on the Million Dollar Pier. It will be called to order promptly at 9:30 a.m. The program for the day follows:

Discussion of reports on:

Individual Paper "Stresses in Track produced by Modern Locomotives," by C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe.

Locomotive and Car Lighting.

Electric Rolling Stock.

Individual Paper "Development of the Electric Locomotive" by F. H. Shepard, director of heavy traction, The Westinghouse Electric & Manufacturing Company.

ENTERTAINMENT

10:30 a.m.—Orchestral Concert, Entrance Hall, Million Dollar Pier.

3:30 p.m.—Orchestral Concert with Impromptu Dancing, Entrance Hall, Million Dollar Pier.

4:30 p.m.—Tea will be served in Entrance Hall.

9:00 p.m.—Informal Dance, Canadian Night with special features, Ball Room, Million Dollar Pier.

Enrollment

The enrollment booth will be open today from 9:00 a.m. to 1:00 p.m., from 2:00 p.m. to 6:00 p.m., and from 7:00 p.m. to 9:00 p.m. There will be a slight variation from this schedule on Saturday. On that day the booth will be open from 9:00 a.m. to 12 noon, 2:00 p.m. to 5:00 p.m. and 7:00 p.m. to 9:00 p.m.

Lost and Found

Lost—One small pocket-book containing diamond pin and a sum of money. Return to Secretary-Treasurer's office.

Lost—Badges 132, 6169, 5829 and 5133 have been lost somewhere on the pier. The finders of the badges will kindly return them to the Enrollment Booth, which is located at the main entrance of the pier.

Found—Ladies' badge 8621. Can be secured at the Enrollment Booth.

Arrangements for Inspecting Diesel Electric Locomotive

In order that any railway man may be able to inspect the first combined Diesel and electric switching locomotive the Ingersoll-Rand Company has arranged to see that demonstrations will be made at convenient times for all those interested. Anyone desiring a demonstration should get in touch with this company at Booth 53. This unit, which was described in detail on page 1159 of the May 10 issue of the *Railway Age*, is now operating in yard and switching service on the Eleventh avenue tracks of the New York Central in New York City. It is a self-contained unit developed by the Ingersoll-Rand Company and the General Electric Company. It weighs 60 tons. has a six-cylinder, 300 hp. Diesel engine direct connected to a 200 kw. generator. The driving power consists of 50 hp. motors geared one to each of four axles. The locomotive was given its first practical working test in actual railway service on the New York Central last Tuesday.

Registration Figures

THE HEAVY lead in registration reported yesterday was maintained throughout the second day enrollment. There has been a decided increase in railroad men over the convention two years ago and the total attendance still beats all records. Below are given comparative figures for the last four conventions, at the time of the afternoon closing of the Registration Booth:

	1919	1920	1922	1924
Members, Mechanical, A. R. A.	458	490	478	650
Members, Purchases and Stores	....	24	16	17
Special guests	471	190	180	305
Supply men	1825	1955	1771	2115
Railroad ladies	550	344	337	475
Supply ladies	350	490	384	484
Total	3654	3493	3166	4046

Yesterday's Entertainment

THE MORNING and afternoon entertainment features of the second convention day were similar to those of the first day—at 10.30 a. m. orchestral concert in the entrance hall of the pier; at 3.30 p. m. concert and impromptu dancing, and at 4.30 p. m. tea was served. The feature of the day, or rather of the evening, was, of course, the grand ball, which forms the culminating social event of the week.

The ball was opened at 9.30 in the evening with a grand march, led by the chairman of the Mechanical Division, John Purcell, with Miss Louise Bentley, and by C. W. Beaver, president of the Railway Supply Manufacturers' Association, with Mrs. Beaver. Notwithstanding the dampness and chill which had prevailed throughout the day, the large floor of the ball room was fully occupied by those participating in the march and exhibit booths alongside, as well as the galleries and other available spaces offered the most complete representation yet afforded of the numbers in attendance. Dancing followed the grand march and furnished pleasing entertainment until a reasonably late hour.

For the success of this crowning event, as well as for the other features of entertainment, a goodly measure of credit is due to C. W. Floyd Coffin, chairman of the entertainment committee, and his able and willing associates, of whom N. C. Naylor was in direct charge upon this occasion. Others of the committee particularly assigned to care for the details of the grand ball, were: George T. Cooke, J. W. Fogg, R. J. Himmelright, Arthur C. Johnson, Floyd K. Mays, Jos. A. Renton, S. Worcester Sargent, Fred. W. Venton, J. H. Van Moss, S. B. Wight, Jr., and W. M. Wilson.

Cornell Alumni Dinner

AS IN previous years, the Cornell Alumni attending the convention are planning to have a get-together dinner. The reunions at Ithaca are held during the week of the convention and the railroad and supply men make up for their absence from these gatherings by getting together on the boardwalk. G. H. Edmonds, superintendent of motive power of the Delaware & Hudson, who is president of the Alumni Association this year, has made arrangements for the gathering at the Traymore Monday evening. Cornell men desiring to register for the dinner should leave their names with A. F. Steubing at Booth 554.

Exhibit Notes

THE STANDARD CAR TRUCK COMPANY of Chicago, in addition to those who were listed in the *Daily Railway Age* of June 11, is represented by A. C. Deverell and R. E. Frame.

Railway Club Secretaries Meet

AN UNUSUALLY enthusiastic and satisfactory meeting of the Society of Railway Club Secretaries was held yesterday at the Marlborough-Blenheim. Every member organization was represented and conclusions reached, from which it is confidently expected results will ultimately follow that will be helpful, not only to many other railroad organizations, but also to the public relations work of general managers of railroads in providing them with a certain measure of co-operative effort.

Bruce V. Crandall, of Chicago, secretary of the Western Club, presided in the absence of W. A. Booth, former secretary of the Canadian Club, who was elected chairman of the society two years ago, but was automatically retired by giving up railroad club work because of important executive duties in the safety department of the National Railways of Canada. His successor is Charles R. Crook.

For a long time it has been the dream of the secretary-treasurer, Harry D. Vought, of the New York and Central clubs to bring about an enlargement of the scope of the society, expecting this would probably finish what he says he expects will be the final work of his active life in behalf of the organized operations of railroad secretaries. Two years ago when the society had its last meeting at Atlantic City, Secretary Vought suggested an association of the secretaries of all railroad organizations and corporations. He was asked to draft a tentative plan and submit it to the next meeting as unfinished business. It was this that occupied attention during the greater part of yesterday's session. Mr. Vought offered his plan, which was received with enthusiastic approval. Following a prolonged discussion, a committee was appointed, consisting of the New York, Central, New England, Western, Pittsburgh and Southern & Southwestern Clubs to study the proposition, offer any amendments or changes which might be deemed essential to its success, and submit a report at a future general meeting of all interested.

In accordance with custom, there was an interchange of thought and experience in conducting railway club business for executive committees and governors. This has always been very helpful to the members of the society, and the clubs have correspondingly benefited. At this time it was found that concentrated effort has brought about such a standardizing of documents, printed forms, methods and practices that just now not much more remains to be done along these lines.

The election of officers resulted in the choice of Bruce V. Crandall as chairman and A. J. Merrill, of Atlanta, secretary of the Southern & Southwestern Club, as vice-chairman, Mr. Vought being continued as secretary-treasurer, an office he has held continuously since completing the duties of vice-chairman and chairman, a number of years ago. With the numerous changes occurring from time to time he is now the dean of all railroad club and association secretaries.

After the meeting adjourned, the members and their invited guests again participated in an enjoyable round-table luncheon at the Blenheim, which has become a regular social feature of these meetings.

American Railway Association—Division V

President Aishton's Address—Program Featured by Two Papers on Modern Locomotive Developments

Chairman J. Purcell called the meeting to order at 9:35.

Chairman Purcell: Yesterday we spent considerable time deciding what constituted an engine failure. I think we arrived at about five minutes detention. The President of the American Railway Association put in some time yesterday trying to decide what constituted floods and washouts. He is here this morning and will tell us all about it. Gentlemen, I take pleasure in introducing to you our President, Mr. Aishton (applause).

President Aishton's Address

Mr. Aishton reviews some of the important activities of the Mechanical Division during the past year and highly commends the work of a number of the committees, particularly the Car Construction Committee, for what it has accomplished in bringing the standard car project to a successful conclusion so far as this Division is concerned.

The good faith of the railroads in their efforts to serve the public better is evident by the large capital expenditures for improvements, cited in some detail by Mr. Aishton.

One of the opportunities of the division for future consideration strongly recommended is the development of cooperative research. This, Mr. Aishton points out, is not incompatible with the continued exercise of individual initiative, in which he is a strong believer. The first step is the removal of the high board fence that keeps a great mass of valuable information unavailable for general use.

R. H. Aishton

Gentlemen of the Master Car Builders and Master Mechanics Associations, Divisiön V-Mechanical, American Railway Association: I know you are all glad to get back to Atlantic City. You have made very definite progress during the past year. A year ago, at this time, under rather unfavorable conditions of weather, acoustics, entertainment and a few other things (which I am bound to admit despite my loyalty to my home city—Chicago), I had the privilege of talking to you regarding a program the railroads had adopted to provide adequate transportation service in 1923, to call your attention to your part in this program and to receive your assurance that you would get behind it. How well you fulfilled your obligation is shown by the performance of the railroads in 1923 and right up to the present minute. There has not been one single question arise as to the adequacy of service

performed by the railroads in the past 14 months, and I want to thank you gentlemen who, in your co-operative work with the other branches of the railroad service, had such a large part in bringing about this result.

The lessons learned in 1923 as to the value of co-operative effort are valuable indeed and this same measure of effort and of performance has been continued up to the present time. A determined effort on the part of everybody having to do with transportation to continue these efforts is a definite assurance to the American people that there will be no stone left unturned on the part of the railways to render adequate service in the most economical and efficient manner, and in this the transportation companies are doing their part in the insuring of the future prosperity of the nation.

High Points of Mechanical Division Work

Now that is all very general. Your convention here today marks another milestone in the records of your organizations and of the American Railway Association. During the past year your division—the Mechanical Division—has done some notable work. The General Committee has had some knotty questions to handle, but that they have been handled in a wise and conclusive way has been due to their great interest and devotion to this work and their appreciation of just what it means. The committees of this division have had a tremendous amount of work put on them. The Committee on Safety Appliances, for instance, of which Mr. Chambers is chairman, and in connection with them the Committee on Brakes and Brake Equipment have done a work for the railroads collectively of a most valuable nature. They have appeared before the Interstate Commerce Commission, before committees of Congress and have done a lot of work in the matter of the power brake hearing alone, requiring several weeks, and indeed months, of continuous effort on their part. The Committee on Car Construction, of which Mr. Kiesel is chairman, has had a most difficult and wearisome job. In the matter of the standard car, steady progress has been made and while it is a fact that the standard car has not yet received the official O. K. of the American Railway Association, I firmly believe that it is on the last lap of the race and that before many moons there will be a complete and unanimous agreement on this matter, and that this is the case is due to the diplomatic, considerate and persistent way in which this committee has done its work. While not yet standard, I think I am safe in saying that the plans as proposed by the committee have had a most potent influence in the cars that have been ordered during the past year, in that the standards developed by this committee have, without formal action, been in a very large measure specified in the new equipment ordered.

The question of the rebuilt car has been a most controversial one. There is lots of argument on all sides of this question. Mr. Kleine is chairman of that committee. I don't know of any subject that has ever been considered by the railroads on which there has been more voluminous information gotten together, or on which there is so genuine a difference of opinion, or in which greater efforts have been made to bring about an understanding. What the final disposition of this matter may be I cannot predict, but with my knowledge of the thorough manner and of the fair-minded work of this committee I can predict that whatever decision is reached it will be a fair one and will be based on the facts.

I have just mentioned the work of these three committees as some of the outstanding things that have been going on during the past year, all in the direction of progress and of providing a greater adequacy of service and of economy in operation. Other committees have also done a vast amount of valuable work.

The Future

What about the future? There are two paramount questions today before the American people. One is, "Can the railways provide adequate transportation service?" This was answered in 1923, is being answered in 1924 and will continue to be answered affirmatively in the years to come, provided the railroads are given a chance to live.

The second great question before the American people is "Are the railroads being efficiently and economically operated?" To show you the angle of thought that is engaging one very large section of the public, the farmers of this country, I am going to quote you a paragraph from an address made by J. R. Howard, former president of the American Farm Bureau Federation, which has been quoted to me recently as representing the attitude of the American Farm Bureau Federation:

"We are asked to pay higher freight rates than those to which we have been accustomed. We are told that the increased railway income is necessary in order to attract capital for just such improvements. What the thoughtful farmer has in mind is reduction in railway operating costs. Therein he sees the only hope for ultimate rate reduction which he demands. He is thinking of the improvements most obvious to him, such as hydro-electric power; but he is coming to know, and I promise you he will increasingly know, something about the more intensive progress in every branch of transportation science. To you gentlemen the confidence and good will of the farmers is vital. You hope they will be patient about rates. You invite their co-operation for a respite from railway legislation. Towards both those problems the attitude of agriculture will be profoundly affected if the farmers are convinced that the strengthened credit arising from the higher rates is to be used in devoting capital to improvements for economy."

What the farmer is thinking about, other sections of the American people are also thinking about and a good many of them on not as intelligent lines as the farmer. How are you going to answer this question, because it has to be answered? As I see it, it is going to be largely through the initiative, the disposition and the resourcefulness of such organizations as the one meeting here today, working co-operatively with the other branches of the service on different propositions, and particularly on those things having to do with more efficient and economical operation.

One of the things that your General Committee has recognized as of importance is the question of the study of the utilization of locomotives to determine:

(A) The percentage of time they should be available to perform actual transportation;

(B) Methods for obtaining maximum efficiency while so available.

If the division didn't do anything else in coming here but finish up the standard car plan, get the answer to the rebuilt car settlement and definitely analyze and report on this proposition they would be doing a splendid work. I mention this, because to make a success of such investigation it requires the united support of all the railroads.

Another matter and having direct reference to the question the farmer is asking, is what results are you getting out of capital expenditures being constantly made, and are they producing the economies contemplated? This is not a committee question, but is a question to be answered by each of the individual railroads. For example, during the year 1923, capital expenditures were made in additions and improvements to shops and engine-

houses, including machinery and tools, to the amount of $51,214,185. There was carried over in unexpended authorization to 1924 the sum of $27,292,000. There has been additional authorizations during the first quarter of 1924 of $9,627,000 and there was actually expended during the first quarter $11,228,000. The farmer, the public and the railroads very properly look for a definite return on these capital expenditures in decreased costs, and the bigger the return the more will be the incentive for further capital expenditures and the more will be the incentive on the part of the public to see that the opportunity is given that will enable such capital expenditures to be made. There is an obligation indirectly on the part of your division, but more particularly a direct obligation on the individual railroads and representatives thereof to use every means within their power and command to bring about the greatest efficiency in the use of these additional facilities.

Another thing, I just made a talk the other day on fuel economy before the International Railway Fuel Association. We have heard a great deal lately concerning scientific investigation, development of methods and appliances for bringing about greater economies in fuel. During the last two decades every known device for bringing about economies has been installed on new locomotives and to a very great extent, on locomotives as they go through the shops. I won't undertake to say what the total capital expenditure has been for these kind of things, but in the matter of superheaters alone it runs up over $125,000,000 and in 1923 alone, there was programmed and being installed superheaters to the value of practically $7,000,000 for this one item alone. The consumption of coal is showing a decrease. In 1923 there was 2.8 lb. less per 1000 gross ton miles consumed than in 1922, and 1.8 lb. less than in 1921.

Get behind this Joint Fuel Committee that your General Committee has established to the further extent of urging a personal responsibility on everyone on each particular line of railroad that has to do with the saving of fuel, and impress this fact that if they would save just one pound on every thousand gross ton miles in freight service and its equivalent in passenger, switch and other service it would mean that you would save $3,165,000 provided the ton miles in this service were the same this year as last.

It isn't a question of appliances; it isn't a question entirely of capital expenditures; it is a question of personal interest and pushing the proposition not only today but tomorrow and all throughout the year. In doing this you are not only answering the question of the farmers as to whether you are getting a return for the capital expenditures, but you will also be providing an argument for a great opportunity for capital expenditures in order that greater possible economies may be made, and will at the same time be providing the opportunity for the securing of such capital. Isn't it worth while? I will say it is.

The Exhibit

The exhibition made by the manufacturers of railway appliances through the Railway Supply Manufacturers Association at this convention is probably one of the largest ever gotten together for a similar purpose, has been brought here at large expense and evinces the realization on the part of the manufacturers of the importance of the development of appliances, tools, machinery, etc., for bringing about greater economy and efficiency, and one of the important features in my opinion of this convention is the opportunity afforded through this exposition to get in touch and acquainted with the latest up-to-the-minute ideas on these matters.

The manufacturers are doing a great service for the railroads and for themselves, and in doing this are doing it for the public welfare as well, in bringing to the forefront those things which avoid waste and produce a better service.

Co-operative Research

Definite recommendations are made to me from time to time relative to centralization of organization for cooperative research. I am a very strong believer in the value of individual initiative. Practically all the progress that has ever been made in this world has been through individualism and the exercise of initiative. One of the deficiencies, as I see it, in your organization today is the lack of a definite collaboration and correlation of the individual research work being done by the railroads on their own lines. Centralization of research or the employment of research specialists will not do this. The first step to be brought about is through a more liberal exchange of ideas. In other words, if somebody develops some method for bringing about a greater economy, keep in the back of your head that what this whole railroad situation depends on is not only on what one railroad does in the line of economy, but on the adoption generally by the railroads of the whole country in as great a measure as is applicable to their particular conditions of that particular economy. Your Mechanical Division has a wonderful opportunity in this, but one of the first things you have got to take down is the high board fence that at the present time keeps this great mass of valuable information where it is not available for general use.

Now I have talked seriously long enough. I am mighty glad indeed to be with you here today and I appreciate the honor of taking part in your meeting. You have a long program with a very large number of very important subjects to be discussed. Keep in mind that the American people have a deep interest in what you are doing, that they have confidence in your knowledge, your ability and your disposition to do everything that is possible through improved methods and through greater diligence, and the measure of that confidence will be expressed as the results you attain are reflected in decreased costs and increased adequacy of transportation.

Vote of Appreciation

C. E. Chambers (C. R. R. of N. J.): I know I voice the sentiment of this assembly of our appreciation for Mr. Aishton's visit and constructive talk, and I move you a rising vote of thanks be given to Mr. Aishton.

The motion was duly seconded and the convention arose and applauded.

Action on Locomotive Design Report

The Chairman: Mr. Bentley was to have Mr. Hoke here this morning to close up the questions raised yesterday on the tractive effort formula.

A. Kearney (N. & W.): Mr. Pilcher is on that committee and is quite familiar with the formula.

J. A. Pilcher (N. & W.): There were two constants named with reference to the engine cut-off. The first one has been recognized; that is, 85 per cent. of the boiler pressure is effective in the cylinders. That is the 90 per cent. cut-off engine. The Pennsylvania in its experiments on the 50 per cent. cut-off locomotives find 75 per cent. of the boiler pressure is effective in the cylinders. In the formula for Mallet engines they simply double those factors on account of the two sets of cylinders, making the factor for the 90 per cent. Mallet cut-off, 1.7 and for the 50 per cent. cut-off 1.5.

H. T. Bentley (C. & N. W.): To dispose of the subject I move that the question of tractive force of Mallet engines be submitted to letter ballot.

The motion was seconded and carried.

Report on Design of Shops and Engine Terminals

The committee, using as a basis the proposed freight car repair shop which was presented in 1920 by the Committee on Repair Shop Layouts, make seven specific recommendations for freight car and repair shops. Five of these recommendations fix certain dimensions which should be used as a basis in building freight car repair shops.

The committee sent out to 33 leading railroads a questionnaire on the subject of car and locomotive shops. The answers received contained a large amount of useful information. Sixteen questions were included in the questionnaire sent to the car shops. They covered the usage of storage bins, kinds of roadways used on which material is trucked, etc.

The locomotive shops of the railroads were asked to answer ten questions which dealt with traveling cranes, balconies, the class of work handled on them, and whether or not they are provided with lockers and washrooms.

A. R. Ayers
Chairman

Last year's committee in its report on design of shops and engine terminals referred to the fact that a vast amount of information had been collected by previous committees on this subject. However, we find in studying the reports of previous committees that no definite recommended practices have been set up or adopted by the association.

In 1920 the committee on repair shop layouts presented a proposed freight car repair shop and with this report as a basis, the committee desires to present the following recommended practices:

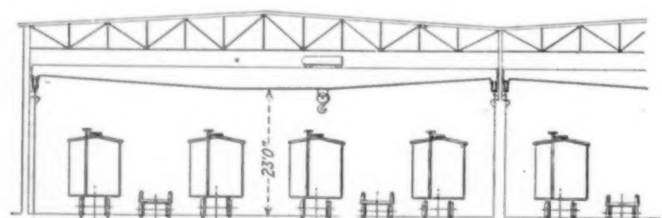
Recommended Practice for Freight Car Repair Shops

1—The distance from the center line of the outside car repair track in a car shop building to any projection on the outside wall should be not less than 11 ft.

2—The distance, center line to center line, between repair tracks that have a standard gage material track between them should be not less than 22 ft.

3—The distance, center line to center line, of repair tracks that do not have a material track between them should be not less than 18 ft.

4—The distance, center line to center line, of car repair tracks where a row of columns is located between the tracks should not be less than 22 ft.



Minimum Dimensions Recommended for a Freight Car Shop

and in no case should the distance from face of columns to center line of adjacent repair track be less than 10 ft.

5—The minimum distance from the top of rail to bottom of traveling crane bridge in car shops that do not lift cars over each other should be 23 ft.

6—Car repair shops should be arranged so that cars can be switched from both ends.

7—Material tracks in car repair yards should be standard gage and planked between the rails.

In view of the fact that this year's committee did not receive any instructions from the association, it has been decided to present certain miscellaneous facts that will be of benefit in the design of modern car and locomotive shops, with particular regard to having shops laid out to facilitate the handling of material with the least number of moves.

The committee sent out a questionnaire on the subject of car and locomotive shops and the answers received contain a large amount of useful information. The replies from thirty-three leading railroads are summarized as follows:

Car Shops

Question 1-A—To what extent are you using material storage bins located in or adjoining your freight car repair yards or tracks? The answers indicated that a large majority of the railroads locate material storage bins in or adjoining their car repair yards.

Question 1-B—Are your material receiving tracks and platforms so located that material from inbound cars is trucked directly to the material storage bins at the repair yards? It appears from the replies that the majority of the railroads prefer to locate their material receiving tracks and platforms so that material can be trucked directly to the material storage bins.

Question 2—What apparatus do you use for transporting and handling material in your freight car repair shops? The reply to this question indicated that electric and gasoline trucks with trailers are rapidly coming into use.

Question 3-A—Are your car shops provided with paved roadways to facilitate trucking of material? The answers to this question indicated that twenty-two of the thirty-three railroads have paved roadways in their car repair shops.

Question 3-B—What type of pavement for roadways has proven to be the most satisfactory? It appears from the replies that the majority of the railroads prefer a permanent type of pavement, as fifteen railroads recommended either concrete, wood-blocks or asphaltic macadam and nine railroads recommended either plank, sills or cinders.

Question 4-A—To what extent do you use lumber storage sheds? It was noted that all the railroads, except four, used some form of a shed to protect their lumber from the weather.

Question 4-B—What type of lumber storage sheds do you recommend? The replies indicate a slight majority in favor of sheds without side walls.

Question 5-A—Do you use electric traveling cranes over your car repair tracks? Seventeen railroads answered in the affirmative and fourteen in the negative.

Question 5-B—What capacity traveling cranes do you use? The replies indicated a considerable difference of opinion as to the capacity of traveling cranes, but the indication is that cranes should have a capacity of 15 or 20 tons.

Question 5-C—Do you recommend the use of traveling cranes for wooden car repairs as well as steel? There were fourteen answers in the affirmative and nine in the negative.

Question 6—To what extent do you use separate tracks for stripping freight cars? A total of nineteen railroads use separate tracks for stripping freight cars and eight railroads do not.

Question 7-A—To what extent do you use separate tracks for painting freight cars? It can be concluded from the answers received that separate tracks for painting freight cars are to be recommended.

Question 7-B—Do you use paint spraying pits for trucks and underframes? Twenty-nine railroads answered in the affirmative and three did not answer.

Question 8-A—To what extent do you sand blast your freight cars? It can be concluded from the answers received that sand blasting cars is not popular as only six railroads reported that they did sand blasting.

Question 8-B—Do you provide special sheds for sand blasting? Two railroads answered "Yes" and twenty-four "No."

Question 9—Do you use dry kilns for drying freight car lumber? Only ten railroads out of thirty-three use dry kilns for drying lumber.

Question 10—What special apparatus do you use for handling mounted and unmounted wheels at your wheel shop? Eight railroads use air hoists and cranes; seven, depressed tracks; five,

monorail hoists; four, hand push trucks; three, electric crane trucks; two, electric traveling cranes; three, locomotive crane and magnet; one, a gantry crane; one, an endless chain elevator, and eight use no special apparatus.

Question 11—Do you have a separate truck repair shop for your freight car trucks? Thirty-two out of thirty-three railroads answered in the negative to this question.

Locomotive Shops

Question 1—What width erecting aisle do you recommend for a transverse pit shop, taking into consideration both steam and electric locomotives? The replies indicate a tendency in favor of an 85-ft. aisle, but on account of the small number of replies, this information is not conclusive. This question was misunderstood by several railroads who took it to mean the distance between center lines of erecting pits. The replies indicated that it is good practice to have pits spaced 23 to 25 ft. apart.

Question 2-A—What capacity traveling cranes do you recommend for handling locomotives? A total of twenty railroads recommended cranes of 200 tons capacity or larger and only eight recommend cranes smaller than 200 tons.

Question 2-B—How many pits will one locomotive handling crane serve? The majority of replies show that one traveling crane will serve between 20 and 30 pits satisfactorily.

Question 3-A—What capacity traveling cranes do you recommend for handling auxiliary parts in the erecting aisle? It was noted that the large majority favored cranes of 10 and 15 ton capacity.

Question 3-B—How many pits will one crane for auxiliary parts serve? There appears to be considerable difference of opinion as to the number of pits one auxiliary crane will serve, but the consensus of opinion would indicate between 5 and 15 pits.

Question 4-A—What capacity traveling cranes do you recommend for the machine aisle? It was noted that 23 railroads out of 33 recommended cranes of either 10 or 15 tons capacity for the machine aisle.

Question 4-B—What machine tools should be served by a traveling crane? The consensus of opinion is that a traveling crane should serve all the largest machine tools, such as wheel lathes, wheel presses, quartering machines, cylinder planers, cylinder borers, slab millers and frame slotters.

Question 5-A—Are your shops equipped with balconies and, if so, what class of work do you do on the balcony? Fifteen railroads use balconies and sixteen do not. The following classes of work are located on balconies: tin shop, pipe shop, electric shop, tool repair and manufacturing, brass work, air brake work, injectors, lubricators, paint shop, wood shop, pattern shop and turret lathes.

Question 6—Do you have locker and washrooms located on the balcony or the first floor and which location do you recommend? A study of the replies to this question indicates that the majority of shops which are not provided with balconies have their locker and washrooms on the first floor, or in an outside building. Practically all of the shops that are equipped with balconies have locker and washrooms on both floors.

Question 7—Have you sub-storerooms in your main locomotive shop building, and, if so, what class of material do you carry in these sub-storerooms? Twelve railroads do not use sub-storerooms and twenty have sub-storerooms. The following material is carried in stock: Nuts, bolts, washers, studs, cotter pins, taper pins, split keys, liners, oil cups, pipe fittings, gaskets, oil, waste and miscellaneous small parts.

Question 8—Should pipe lines between shop buildings be located in underground tunnels or on posts overhead? Twenty railroads prefer underground tunnels and twelve prefer overhead on posts.

The report was signed by the following committee: A. R. Ayers (chairman), N. Y. C. & St. L.; A. C. Davis, Pennsylvania System; J. S. Downing, C. C. C. & St. L.; B. P. Phelps, A. T. & S. F.; Henry Gardner, B. & O.; J. Burns, C. P.; W. A. Callison, C. I. & L.

Discussion

W. A. Callison (C. I. & L.) (reading the report in the absence of Chairman Ayers): The A. R. E. A. Committee on Shops and Locomotive Terminals accepted the first six of the items which we are recommending for adoption as recommended practice. They have substituted the following for item 7, which they divided into two parts:

First: "Material tracks in car shops and yards should be standard guage." You will note this is the same as the first part of our recommendation No. 7, except that the word "shops" has been added.

Second: "That portion of the car repair shop floor, between the outer rails of adjacent repair tracks having a material track between them, should be planked or paved and suitable planked or paved roadways should be extended out into material yards to facilitate trucking and the use of tractors for handling material."

Mr. Bentley: I am at a loss to know how to discuss the paper, in fact I looked at a number of dimensions and found it was possible to take my choice in aisle widths from 67 ft. to 125 ft. and pit centers from 20 ft. to 30 ft. This difference in the replies goes all the way through and does not mean very much unless the detailed conditions that brought out these replies is known.

The size of power used has a great deal to do with the capacity of cranes as well as with pit centers, pit lengths, aisle dimensions and practically all other subjects mentioned, and therefore the committee would have difficulty in giving any definite figures that could be made use of to fit every condition and particularly so without knowing the shape, size or location of ground available.

The size and kind of power in use must be considered in the lay-out of a new shop plant and provision made for extensions and increase in size of power.

The cost of constructing building can be very materially reduced by having whiting or similar lifting appartus instead of overhead cranes, or using a special building as a stripping and wheeling shop that would be equipped with the size of crane or cranes to handle the power in use, with a proper margin to take care of increased weights of locomotives that might later be used.

The cranes for handling auxiliary parts should be not less than 10 tons capacity and one to each five pits is ample to promptly take care of conditions when a full shop force is being worked.

The design of a shop should be made to provide balcony space which can be used to good advantage to take care of the lighter work. All heavy material should be machined on ground floor to reduce expense of handling.

Lavatory and locker accommodations must be provided on balcony and ground floor and in such locations that time will be conserved in men going from and to work.

All large tools should have ample and suitable crane service.

Substorerooms and tool rooms, perhaps combined, in a large shop are a necessity and save time of employees.

With the increased size of power every effort must be made to provide terminal facilities that will quickly enable power to be repaired and turned so as to increase its utility and decrease terminal delays. Coal, water, cinder, and inspection pits, sanding facilities should be so located as to permit of taking coal or water and sand on ingoing and outgoing tracks. One of the big handicaps in the ordinary engine house is lack of ventilation, heating and illumination, all of which are important items.

All important roundhouses should have a sub-store and tool rooms, with a well equipped machine shop conveniently located so that running repairs requiring machine work can be handled without disturbing shop forces. Drop pits are absolutely necessary for wheel work and a hoist of the Whiting type for wheeling and unwheeling locomotives where a back shop is not at a convenient distance.

The Chairman: Mr. Robinson of the Illinois Central was to discuss this paper, but he is not here this morning and the Secretary will read his remarks.

Lee Robinson (I. C.): The committee has made few definite recommendations for car shops, except those relating to certain clearances and track spacing. These provide ample space for handling work and should prove satisfactory. If material tracks and push cars are not used and some other method of handling material is adopted, different track spacing would probably be advisable. There is probably no one item that is as important

as that of providing facilities for prompt and economical handling of material. Delay in getting needed material to the men means money wasted.

Storage bins for small material, conveniently located in the repair shop and along the repair tracks, will result in a saving in time. Ample provision should also be made in a car shop for storage at convenient locations of a suitable number of tools, jacks, horses and trestles to meet all demands and necessitate as little movement about the shop as possible. In other words, so locate facilities that workmen will have no excuse for going any great distance from his place of work, which means a saving of time.

The old, slow moving push car with its system of fixed tracks and cumbersome turntables must give way to more rapid methods for handling and delivering material and the development and increasing use of gasoline and electric tractors and trailers, together with crane trucks, indicates this is gradually taking place. Full use cannot be made of such devices, however, unless paved intercommunicating roadways are provided, hard roads are coming to be recognized as just as necessary around railroad shops as on public highways. In order that equipment of this nature may deliver its load direct into the shop at the point to be used, a suitable floor must be provided in the car repair shop. A car shop entirely floored would facilitate handling material, permit it to be kept free of scrap and rubbish and allow greater freedom of movement on the part of the workmen in performing their duties. The combination of paved roadways, well floored shops, power driven tractors and overhead traveling cranes represents the best method of handling material of all classes with a minimum of manual labor.

It might not be amiss to state that properly designed, equipped, lighted and heated shops must be considered as essential for the proper maintenance of freight cars as for the maintenance of passenger cars and locomotives. If we are to keep abreast of past records of car movement and prompt deliveries of shipments in good order, we must be reasonably sure of reliable performance of the freight car while in service and of a minimum time out of service on repair tracks. This can best be accomplished by always making substantial repairs, and to do this, adequate facilities should be provided. The freight car is receiving its share of attention in regard to improvements to meet the heavy service of today and repair shops necessary to maintain its proper condition to remain in service must receive the same attention. It is probable that in time a freight car failure will be treated and handled in much the same manner as an engine failure. It is hoped that definite recommended practices covering freight car repair shops will be adopted by the Association.

Lumber-storage sheds for housing finished lumber are generally recognized by railroads as a necessity.

Traveling cranes for both wood and steel cars will be found to be a good investment by reason of the saving in time on such operations as handling heavy material, lifting cars instead of jacking, and even moving cars from one track to another. On steel coal cars, and in many cases steel underframes, these can be turned completely over by means of overhead cranes, permitting work to be performed on the underside much more conveniently than when working from underneath the car. Where shops have been provided with separate tracks for stripping and painting, the advantages derived from such an arrangement have been reflected in more rapid movement of cars through the shop.

Spraying pits for painting and sand blasting apparatus should be considered more as special or auxiliary facilities to serve certain types or classes of equipment, or to meet certain conditions and recommended only where they are particularly adaptable.

Cranes and air hoists and monorail hoists probably constitutes the most flexible arrangement for handling wheels at a wheel shop.

The general practice in repairing trucks appears to be to do this work in the car repair shop and adjacent to the car undergoing repairs, due to less handling than if performed in a separate shop.

It is to be expected that there would be quite a divergence of opinion and practice in regard to locomotive shops due to variation in size and weight of locomotives owned by various railroads.

For a transverse pit shop, an erecting bay ranging from 85 ft. to 95 ft. in width would appear ample to serve the majority of the present day locomotives. This width depends also on what practice is followed in disposing of driving wheels after removal, whether they are stored at one end of the pit, or carried to another location in the shop, or to a separate wheel shop when engine is unwheeled.

A distance between centers of pits of not less than 24 ft. indicates the best practice. Handling engines in the erecting shop designed to accommodate every inch of available side clearance and, considering the number and size of attachments and devices on modern engines, ample floor space between pits is necessary, particularly when the use of portable machine tools is employed.

The capacity of traveling cranes for handling locomotives naturally depends on the maximum engines each road operates or intends to operate; 200 to 250 ton cranes will meet practically all conditions now existing. One crane for handling engines should easily serve 30 pits and two auxiliary cranes should be capable of serving the same number of pits as the engine crane. A 15-ton crane is a convenient size for an auxiliary, but the selection for this purpose would depend largely on individual opinion as to the maximum piece to be handled. Inasmuch as cranes in the machine bay will handle considerable of the same material as auxiliary cranes in the erecting bay, they should be of the same capacity. General practice indicates that large machines are located so as to be served by a traveling crane.

Where ground space is available and from a standpoint of convenience to workmen and handling material, it would be preferable to construct machine shops without balconies. Better natural lighting usually results when balconies are eliminated. Where space is available, wash and locker rooms should be on the ground floor. Substorerooms is a locomotive shop building usually occupy space which should be devoted to other purposes. Where a storehouse is properly located and a good system of distributing material is in effect, such a facility is hardly necessary.

In cases of main supply lines of any considerable size, or where a number of lines can be grouped, they should be placed in tunnels, provided good drainage is assured. Such tunnels should be of ample size to permit repairs to be readily made. All other lines to be carried overhead wherever possible. The practice of burying pipe lines in the ground should be discouraged.

E. R. Breaker (S. A. U. & G.): The question of the substore room seems to be one on which there is a difference of opinion. My experience in the last couple of years with a roundhouse taking care of about ten engines a day, is that it is the best paying investment that we have ever put in. We put in a tool room and a substore room in a roundhouse. We handled in that nuts, washers and a few spring hangers, and in addition to that kept piston packing and valve stem packing of different sizes for every engine we handled at that roundhouse. We found it

saved the time of the mechanics and resulted in a tremendous saving in proportion to the total amount of time employed.

F. W. Brazier (N. Y. C.): In building a new shop and sending a committee around to visit roads, we get better results by going to roads that are rather hard up. They will show you more than the up-to-date roads can in a great many things.

The report suggests that the car shops be arranged so that cars can be switched from both ends. That is an ideal condition. As a general thing, railroads are forced to put up shops in some place where they have not the room nor the land to get around, and the result is that it is very expensive. It would be much better if they could get out of town where they could have more room.

The planking between tracks is not so important as it is to plank outside the tracks where you do jacking and have horses so that they will not sink into the ground. Another way to save money is to use macadamized stoning. It makes a fine roadbed and will do very well between the tracks.

J. J. Tatum (B. & O.): The facilities in shops is one of the greatest subjects before American railroads today. Gigantic shops with great facilities are good things to have. Mr. Brazier just said that if you want to learn something go to the poor railroad. I agree with him. On the other hand, let us go and find them as they work every working day in the year. Any set-up proposition for you to look at does not mean anything.

I remember in the eighties that we had in the B. & O. shop eight men that could build two 28 ft. box cars every nine hours for any month in the year they might work, but we did not have eight other men that could do so. Yet those men that were working in those shops were supplied with facilities in the same manner as the eight men I speak of as making the record for the shop.

What is the condition of your shop? What are your men doing every day? How much lost time is there? Are your men going after the material needed to build the car or the locomotive? Has the material all been assembled as it should be? Have you done your part in having the material where it will be used? If not, your men are not to blame for not building a car or an engine in less time.

In the best regulated shops you find today the tendency is to get the material within the man's reach if it can possibly be done and the material should be fabricated properly so that when he gets it it fits.

In a car shop there should be a track designated where the stripping is done. The car should be stripped of all the material that is of no further value, and it should be disposed of in the proper way with one handling if possible. The material that is to be reclaimed and reworked should be removed to the fullest possible extent. That material should be carried immediately to the point where it is to be put into condition for re-use. After that is done the car should then be moved to the point where the next operation is to be done. After that operation the car should be moved to the next stage of its work, and so on until it is through. In setting up the movements for your car you should be sure that there has been no lost time but that every move made by every one of your men has been effective.

J. Roberts (C. N. R.): In connection with overhead electric cranes, the committee should consider the proportional capacity of cranes for handling locomotives. Reference was made to using 200- or 250-ton traveling cranes in a 30-pit shop. That would necessitate the crane making about eight lifts a day. Therefore, a 15-ton capacity crane working in conjunction would be too light to handle boilers of the capacity that the 200-ton cranes are handling. It seems to me that the proper proportion would be, if the shop is using a 200-ton crane, to have not less than a 25-ton crane working in conjunction with it to handle a locomotive boiler of that type.

Mr. Chambers: I agree with Mr. Tatum's idea of the place for stripping cars, outside if possible. For a number of months we have been working on the problem of station-to-station repairs to cars, and on the same class of equipment, the same men and the same place, we have reduced the time consumed on rebuilding cars by the station-to-station practice by from 18 to 20 per cent. It keeps rubbish out of the shop and permits you to specialize the men. You get your greatest output by specialization. I wanted to ask a question about the proposed construction of a car shop showing a spacing of about 83 ft. for four tracks, the crane covering all four tracks. The construction could be cheapened materially by cutting it down to two tracks per crane or not more than three. Trussing is heavier when four tracks are covered, and the crane must be much heavier to span that distance and carry the load required.

Mr. Callison: We gave that careful consideration. To avoid as many columns as possible, was our reason in going to the four tracks.

E. G. Chenoweth (C. R. I. & P.): I wonder if the questionnaire that was sent out gives the exact information that we desire due to the fact that it asks the railroad to give their present practice. Some of us are not as up to date in our shop as we want to be. Would it not be a good idea to ask the question, "What is your recommendation for an up-to-date shop?"

In a repair shop, especially where heavy repairs are made that scaffolding is one of the most important things, and where we have permanent scaffolding, I do not believe 22 ft. is enough distance between the tracks, where we also have an industrial track between. My recommendation is that should be at least 24 ft.

Where a permanent scaffold is used we should have the lighter material distributed not only to the car but to the platform. This stops the man not only walking 100 ft., but eliminates climbing off the platform and up again.

Mr. Bentley: In regard to the capacity of cranes and their location, we have had in operation for the last few years what we call a stripping shop where we leave all the dirt as the engines are being stripped. From there they are taken into the main shop with a lighter crane. It makes a very nice arrangement. Has any consideration been given to a shop set apart specially for stripping locomotives and a main shop of a lighter and cheaper construction where the repairs are made?

Mr. Chambers: How far should such a stripping shop be from the main shop?

Mr. Bentley: We have a 25-stall main shop and the stripping shop is separated by only one track which makes it very convenient. The material is close.

H. D. Webster (B. & L. E.): Mr. Bentley touched on the heating, lighting and ventilation of the roundhouse. On our road, about ten years ago, we built a blacksmith shop in which the walls were painted white. The walls of our machine shop between the windows are also painted white. We get better light on the machine tools and the men are pleased with it. It has, however, resulted in better cooperation between them and their employers.

Could not some one give us some light on the advantages of a locomotive cleaning plant? You cannot tell whether you have a crack in an engine frame if it is covered with grease and dirt. If we could wash such parts it would give our inspectors a chance to inspect the parts of the locomotive and find the defects.

W. B. Harrison (A. T. & S. F.): I am handling at our terminal about 80 engines a day. We have been very successful since we have installed plants for washing locomotives. It has given us clean engines and has been successful in enabling inspectors to find defects.

P. C. Withrow (D. & R. G. W.): In our car shops we have a movement of the cars so that the men do not leave their stations at any time, but the car is moved along in successive stages and the material is all delivered right at the point where it is used. The first thing is the stripping track, and from there the car goes into the steel shop where the steel work is done. It then goes to the wood car shop, and so all along. We have balconies on both sides of the car and all the material for the upper work is carried on the balconies. It has worked out very successfully and I suggest that the committee look into that design of shops.

(Upon motion of Mr. Bentley the report was accepted and the committee continued.)

Engineering and Business Considerations of the Steam Locomotive

By W. H. Winterrowd
Assistant To President, Lima Locomotive Works

Mr. Winterrowd disputes the impression of the uninformed reader that the steam locomotive is inefficient and losing its vitality. He develops the point that during the last twenty years the maximum thermal efficiency of the locomotive boiler has been increased approximately one-half. A comparison of the thermal efficiency curves of a locomotive and a stationary boiler proves conclusively that the locomotive boiler is the more efficient generator of steam. It is pointed out that still greater maximum thermal efficiency can be obtained in the future by further development of superheated steam, larger grate area and higher boiler pressure.

The paper further states that it is a business necessity for every railway to have constant and accurate knowledge of the economic value of its power. In order to make a proper economic analysis of the value of power, due consideration should be given to the latest development in the art of locomotive construction and operation.

W. H. Winterrowd

"The Locomotive is the most vital element in railroad operation." You have seen this tablet in the Grand Central Terminal, New York City, where the New York Central has on display its wonderful exhibit depicting the evolution of railroad transportation.

During the past few years, almost periodically, the press has presented to its readers statements conductive to the belief that the modern steam locomotive, if vital, is rapidly losing its vitality. The uninformed reader is left with the impression that the modern steam locomotive is inefficient, that it has reached a stage of development where further improvement can not be offered, and that a point has been reached where it can not meet practically and economically the traffic conditions of today.

Nothing could be farther from fact. The vitality of the steam locomotive is not on the wane. It is increasing. Development has not stopped. It is still in progress. The possibilities of increased efficiency and capacity guarantee a continuing progress. The remarkable development that the steam locomotive has undergone during the past twenty years is briefly indicated in the following comparison:

Year	Road	Class	Weight of engine	I. h.p.	Lb. per I. h.p.
1904	P. R. R.	2-8-0	194,200	1036	187
1904	L. S. & M. S.	2-8-0	181,300	1053	172
1918	U. S. Gov.	2-8-2	292,000	2434	120
1922	S. P.	2-10-2	398,000	3136	127
1923	N. Y. C.	2-8-2	335,000	2965	113
1923	P. R. R.	2-10-0	371,800	3486	106½
1923	U. P.	4-8-2	345,000	3500	98½

A comparison of the extreme figures for 1904 and 1923 shows that with a 91 per cent. increase in weight a gain of 236 per cent. in indicated horse power, the improvement is approximately 48 per cent.

During the same period there was a very remarkable gain in thermal efficiency, or in the "efficiency of the fuel from coal to driving wheel contact with the rail." The following table shows that the maximum thermal efficiency as increased from 5.22 per cent. to 8.1 per cent. or an increase of approximately one-half.

Year	Road	Class	Maximum thermal efficiency
1904	P. R. R.	2-8-0	5.13
1904	L. S. & M. S.	2-8-0	5.22
1923	P. R. R.	2-10-0	8.1

The importance of this development in conjunction with all the signs that point to much greater improvement have not been properly evaluated by those who urge a substitute for the modern steam locomotive; nor has proper consideration been given to the fact that it is possible to increase the capacity of the less modern locomotives and at the same time raise their efficiency to a point approaching that of the modern unit.

Any study of a substitute must include a consideration of not what the steam locomotive has done in the past but what it is doing now and what it will do in the future. If comparisons are made, the economies obtainable with the most modern form of locomotive should be used, otherwise the conclusions will be misleading.

A study of the data relating to the increase in capacity and efficiency of the steam locomotive, is of value because it affords an indication of the direction that future development is likely to take.

The accomplished increase in weight and capacity with its corresponding decrease in weight per indicated horse power is the joint result of increase in size and efficiency refinements. At the present time, physical limitations have been approached to such an extent that any future increase in capacity due to size will not be at the same rate as in the past. As a result, the greatest development of the future may be expected to take place in improvement of the locomotive as an efficient power plant. The particular direction that this development may take is best indicated by considering the locomotive boiler and engines separately.

Thermal Efficiency of the Locomotive Boiler

Steam locomotive boilers have been said to be wasteful and inefficient. A glance at the curves in Fig. 1 disposes of such statements. These curves establish the commanding fact that the locomotive boiler without having reached its limit is a more efficient generator of steam than the boiler in present day stationary plants of maximum refinement and that its heating surface is a far greater producer.

In Fig. 1 the curves are plotted to show the combined efficiency of boiler, superheater and furnace at various ratings of normal boiler capacity and at varying rates of evaporation for both locomotive and stationary boilers. The curves No. 1, No. 2 and No. 3 are for modern locomotive boilers on engines in freight and passenger service. Curves No. 4, No. 5 and No. 6 are for modern stationary boilers in very large power plants representing the highest development of the art. It is important to note that the maximum capacity of these stationary boilers lies below the average capa-

city of these locomotive boilers. A comparison of these capacities takes on added significance, when it is remembered that the natural draft stationary plant greatly exceeds in cost, and space occupied, the forced draft locomotive plant.

Curves to be made in the future will be still higher in the case of the locomotive when equipped for tests with Type E superheater and feed water heater. Maximum combined efficiency closely approaching 90 per cent. is in sight. The marked gain made possible by the use of the Type E superheater indicates the very great possibilities of future gain due to the use of high temperature steam.

It may not be amiss at this point to make mention of a fact that does not seem to be fully recognized. As boilers have increased in size, the steam space above the water level has decreased, with the result that under operating conditions more and more moisture has been carried over into the superheater with the steam. The superheater has therefore been serving the double purpose of an evaporator and a temperature increaser. That the superheater has evaporated this moisture and in addition has increased the temperature of the steam, coincident with increasing boiler efficiency and capacity entitles it to a maximum of credit. This indicates, however, that if moisture can be removed from the steam before it reaches the superheater, that device can function 100 per cent. as a superheater and do still more to increase the capacity and efficiency of the boiler. Steam separators are useful in this connection.

It is also consistent to emphasize the fact that the use of superheated steam in all the locomotive auxiliaries will increase boiler capacity in the sense that it will decrease the demand for steam.

It is well known that in a locomotive boiler, the greatest amount of water per pound of coal is evaporated when combustion occurs at a low rate in pounds of coal burned per square foot of grate area per hour. This fact is responsible for the growing tendency to use large grates. To take full advantage of this fact will require a grate area that will be responsible for some increase in weight. It also necessitates the use of a mechanical stoker, adding still more weight. But the effects of the increased weight can be neutralized by the use of a four-wheel trailer truck.

Tests made by the American Railway Engineering Association's Special Committee on Stresses in Railroad Track show that the use of a four wheel trailer truck will eliminate the concentrated load which placed at too great a distance behind the driving wheels is responsible for exceedingly high rail stresses. Trailer loads can be distributed and rail stresses reduced to such an extent that the increased weight will not be a factor in establishing limits of design.

It may be suggested that the use of large grate areas will considerably increase locomotive standby fuel losses and increase the amount of fuel burned when the engine is worked light. The increasing tendency to keep locomotives in continuous service with a minimum of standing time and the economic necessity for giving each locomotive its maximum load will offset this. In fact, this type of construction will lend itself to more continuous service for several reasons. In the first place, there will be less necessity to take the locomotive out of service for boiler and firebox maintenance, because the decreased rates of combustion will result in less severe firebox punishment. This construction will also lend itself to better ash pan conditions. The relatively large space made available by this type of truck will result in large ash pans that will provide sufficient capacity to carry the locomotive over more than one division, thus cutting down time at divisional points.

Another field for increased thermal efficiency is the use of steam at pressures considerably higher than those prevailing today. At the present time, high steam pressures are being given a great deal of consideration in both locomotive and stationary fields. It is being considered in the locomotive field, first, because large increases in pressure can be accomplished with the addition of a comparatively small number of heat units per pound of steam, and second, because advantage can be taken of high steam pressure to use the steam expansively.

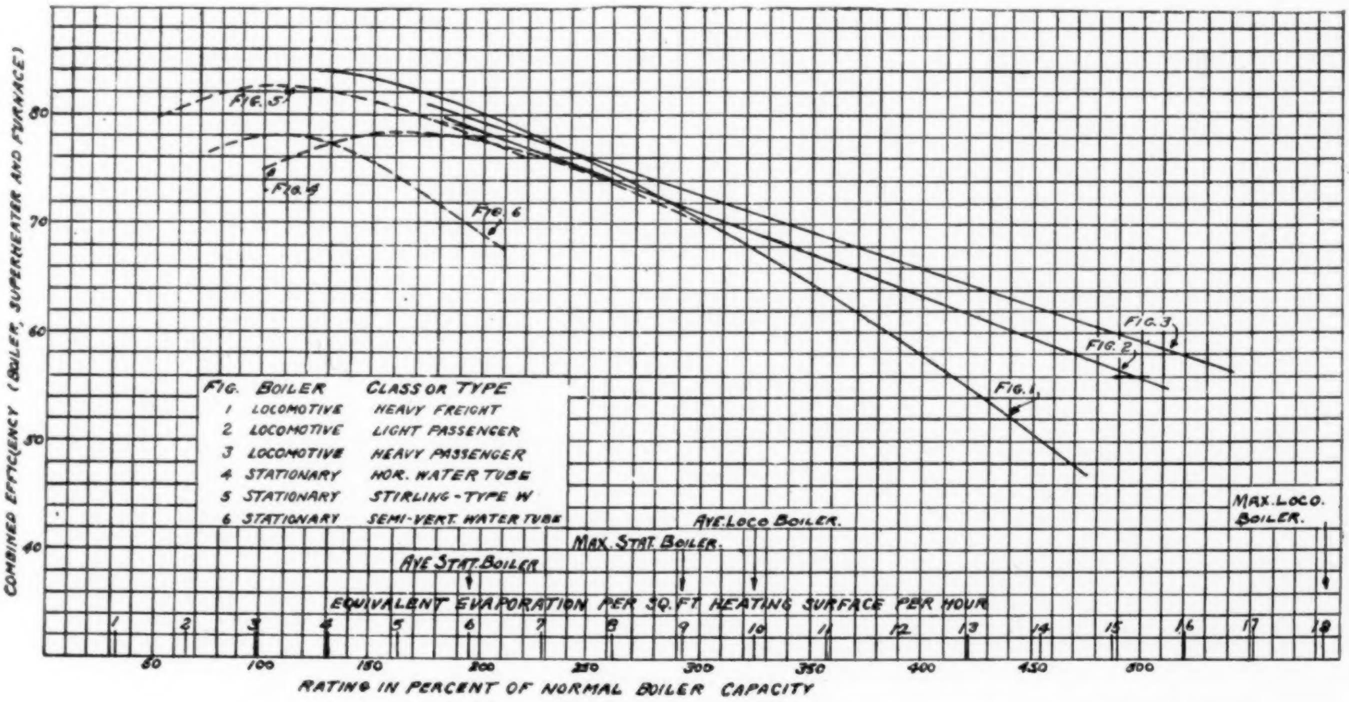


Fig. 1—Curves Showing the Combined Efficiency of Boiler, Superheater and Furnace for both Locomotive and Stationary Boilers

Locomotive Design and Performance

To utilize the high pressure steam expansively and with maximum efficiency leads to a consideration of engine design and performance. The boiler must also be considered but chiefly in the sense that type, design, construction, weight and probable maintenance will be the principal factors in the determination of the practical limit of high pressure.

Efficient utilization of high pressure steam is a matter of using the steam expansively. In the most modern stationary plants, this is generally done by expanding superheated steam continuously through many stages in a single turbine, or by expanding it down to a comparatively low pressure in a high pressure turbine, reheating the steam and then expanding it still further in a low pressure turbine. In both methods, condensers make it possible to obtain a maximum amount of energy from the steam.

To date, United States locomotive practice has not involved the use of the turbine. In Europe, several turbine locomotives are in service. These are condensing types with turbines and driving wheels connected by reducing gears. While the turbine locomotive offers rather alluring possibilities, its use in the very large units necessary in United States practice involves a satisfactory solution of the following problems, which should be given very careful consideration by any one considering this type of locomotive. In the first place it involves the matter of steam condensation. This involves numerous problems in itself. In the next place, the maximum efficiency of the turbine is limited to a comparatively small range of its speed. Still another problem is the matter of revers-

ing. Finally, the turbine locomotives that have been constructed to date are of comparatively heavy weight for the horsepower developed.

Up to the present time, the efforts in the locomotive field of this country have been confined to the expansive use of high pressure steam in cylinders. So far, actual construction has confined itself to two methods. In one case, the locomotive is of the cross compound type and steam is used expansively, first in a high and then in a low pressure cylinder. In the other case, the locomotive is of the simple type with valve motion so designed that identical limited cut off in each cylinder insures expansive use of the steam. In the latter case the increased pressure insures the required mean effective pressure in the cylinders and the limited cut off results in an expansive use of the steam which means increased fuel economy.

A locomotive of the first type has just been constructed and will go into service shortly. The boiler is of the firetube type with a water tube firebox and carries 350 lb steam pressure.

More than 600 locomotives of the second type have been constructed and are in service. These locomotives are equipped with standard locomotive boilers carrying 250 lb steam pressure. It is on locomotives of this type that the highest efficiencies have been achieved. Moreover, they have been obtained with a maximum of simplicity and uniformity of turning torque. On these engines dry coal rates of less than 2 lb. per i. hp. hr. have been obtained. The minimum rate as less than 1.75 lb.

Some constructional advantages resulting from the use of high pressure steam lie in the fact that cylinder diameters can be decreased, the weight of reciprocating parts somewhat reduced, and within certain limits, boiler weights can be reduced. The use of steam pressures higher than those just mentioned is not improbable and developments in this direction will be watched with a great deal of interest.

A number of other possibilities exist that may eventually serve to increase locomotive efficiency still further. From time to time, efforts have been made to reduce or eliminate cylinder back pressure by methods other than those involving condensation of the steam. Some of these have involved the use of mechanical draft. The possibilities of increased efficiency and capacity make this an attractive field. The elimination of back pressure by condensing methods has been given a great deal of consideration but so far, no solution of the problem has been offered that appears entirely practical to deal with the quantities of steam involved in the really big locomotive of today.

It is also important to mention the very great value of a properly designed valve gear with adequate valve travel in reducing back pressure and improving cylinder performance.

A reduction of internal friction affords additional possibilities for increased efficiency and capacity.

In an effort to take advantage of its high thermal efficiency, serious thought is being given to the applicability of the internal combustion motor to the railway motive power field. There is not yet in sight a solution to the practical problems that surround the application of this type of power to make it meet the special and exacting requirements of the large units necessary for economical operation in this country.

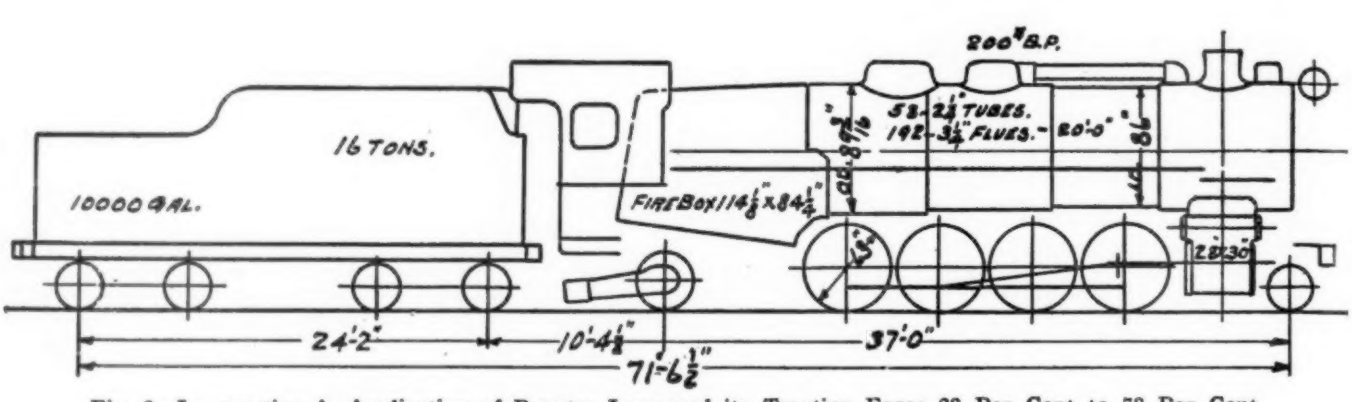


Fig. 2—Locomotive A, Application of Booster Increased its Tractive Force 28 Per Cent to 78 Per Cent, Depending on its Rate of Speed

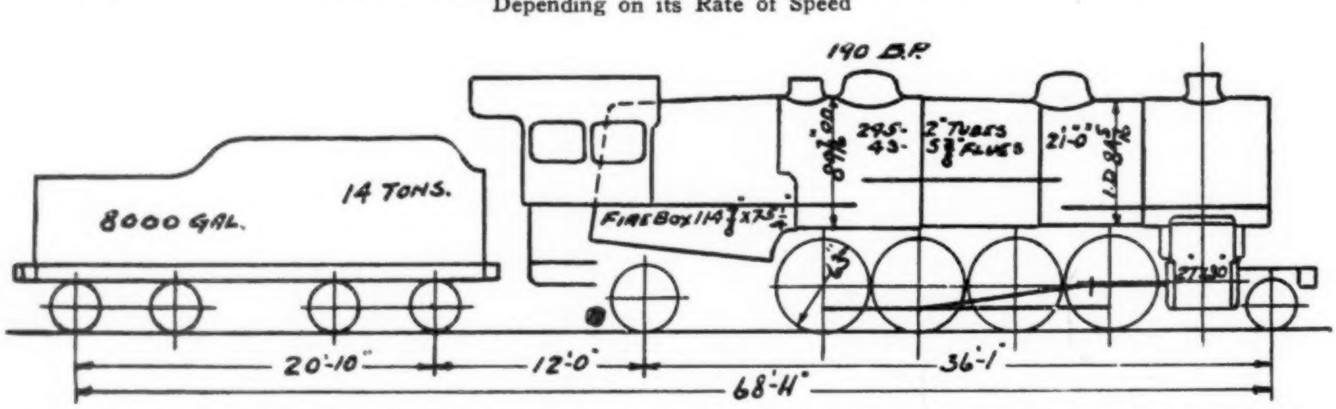


Fig. 2—Locomotive B, Showing General Dimensions of a Fairly Modern Locomotive not Equipped with a Booster

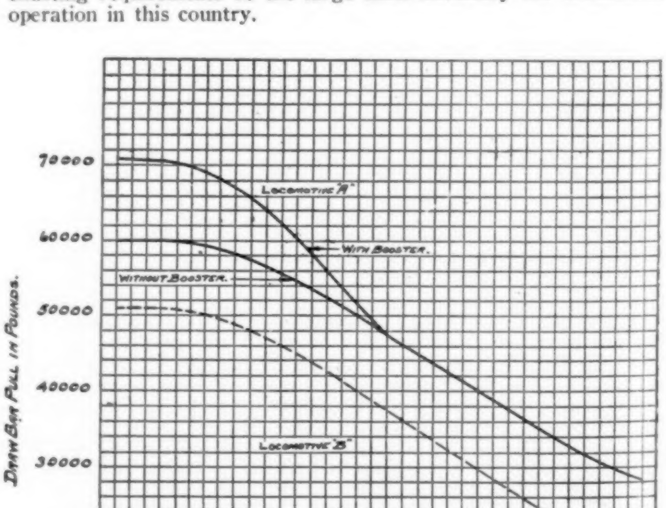


Fig. 3—Speed-Pull Curves Showing Great Increase in Capacity of Locomotive A over Locomotive B

As an example of one method used to increase locomotive capacity and efficiency by modifications within the unit itself, the three-

cylinder simple locomotives put into service recently are of interest. The uniform turning torque made possible by the use of three cylinders is responsible for increased tractive force while the increased number of cylinder exhausts make a more uniform smoke vacuum resulting in improved combustion conditions.

As an outstanding indication of what can be done in the way of increasing locomotive capacity, chiefly by co-ordinated design and with but a very slight increase in size and weight, attention is directed to the diagrams and curves in Figs. 2 and 3. In Fig. 2, locomotive B represents a design that is fairly modern. Traffic grew and conditions changed to such an extent that the railroad concluded it would be profitable to operate locomotives of greater capacity but which must not exceed certain weight and size restrictions. Locomotive A was the result. A comparison of engine weights is as follows:

	Locomotive B	Locomotive A
Weight on engine truck, lb.	27,500	29,000
Weight on drivers, lb.	245,000	248,000
Weight on trailer, lb.	49,500	58,000
Total weight, lb.	322,000	335,000

It will be seen that the greatest increase in weight was made on the trailing wheels due to the application of a booster. Additional weight on engine truck and drivers is comparatively small.

The speed-pull curves in Fig. 3 show the very great increase in capacity of locomotive A over locomotive B. With but slightly more than a one per cent. increase in weight on drivers, and a total increase in engine weight of but approximately four per cent., the majority of which was due to the application of a booster on the trailing wheels, starting tractive effort was increased 20,000 lb or 39 per cent., and at speeds over 18 m. p. h. tractive effort was increased between ten and eleven thousand pounds. At 20 m. p. h., this is an increase of practically 28 per cent. At 30 miles, it is an increase of 47.8 per cent., while at 40 m. p. h. it is an increase of approximately 78 per cent. This increase from 28 per cent. to 78 per cent. means decreasing the time between terminals with a heavier load. It shortens the railroad.

On the basis of this increased capacity the operating officer possesses motive power units, three of which will accomplish the work previously done by four; and this with a locomotive burning no more coal than its predecessor and not exceeding by more than four per cent. the weight of locomotives now generally considered up-to-date.

Such motive power, co-ordinated to produce results like these, is an investment that places in the hands of the operating officers a means to revolutionize his operating figures. Its value in money can hardly be estimated.

Consideration of all the foregoing relative to the rapid development of the steam locomotive might lead to the conclusion that in the past the locomotive has rapidly reached its limit of usefulness on account of obsolescence. In many cases, economic conditions have made this true. In the majority of cases, it has not been true for the reason that additions and betterments to the locomotives themselves have increased their efficiency and capacity and greatly prolonged their useful life. These fuel saving factors and capacity increasers have been instrumental in preserving a very large original investment, and in making possible a much greater return on that investment. There are still a great many locomotives in service that can be made useful units in economic railway operation by the addition of these factors.

The Locomotive as an Economic Unit

The very great and rapid growth of transportation as well as the radically changing conditions contemporaneous with that growth have resulted in conditions that make it a business necessity for every railway to have constant and accurate knowledge of the economic value of its motive power. Without that knowledge, it is not possible to operate motive power to maximum advantage nor to make it earn the greatest possible return on the investment.

To obtain such a comprehensive view of motive power requires an analysis involving vital factors. It involves not only a consideration of the physical characteristics of the property but a consideration of the nature of the business both present and future, the most advantageous assignment and operation of motive power, the character and condition of the equipment, labor conditions, and a knowledge of how to consider these and other factors in the light of a business investment. A sound consideration of motive power as an investment in turn involves a reliable knowledge of the latest development in the art of locomotive construction and operation.

An analysis of this kind is not a simple matter if made with the object of producing accurate and reliable data that will enable the railway executive to exercise his sound business judgment in an economic consideration of the subject.

How is this analysis often made? What sort of a yard-stick does it generally produce and is it a measure that enables the railway executive to correctly ascertain and judge the value of his motive power from a business standpoint?

This is a matter of very great importance and it is the opinion of the writer that this Division of the American Railway Association can render exceedingly helpful service by assistng to establish a definite method of analysis that will at all times insure a proper economic consideration of this question.

The thought has been expressed that increased efficiency and capacity are purchased at the expense of locomotive simplicity, and increase in maintainance costs. This is true but can the results be attained in any other way? The history of the development of motive power of all kinds indicates that it can not. The so-called complications are absolutely essential to increased efficiency and capacity and must be considered in the broad business sense that they greatly increase the economic value of the locomotive, so much so in fact that the additional cost of maintainance is a small item in the greater returns made possible with the improved unit.

In connection with maintainance, the writer feels constrained to draw attention to the fact that for any economic consideration of the subject, maintainance cost based on the locomotive mile unit is not a reliable criterion.

Exceedingly important factors in the cost of running and shop repairs are the size and capacity of the locomotive and the rate and amount of work that it actually performs. The mileage basis eliminates these factors.

Considered on the mileage basis, the maintainance of the so-called modern locomotive will exceed that of the old locomotive. But if the improvements are factors that result in substantially increased capacity, the locomotive will do more work than its old sister and the additional maintainance will be more than offset by the increased earning capacity of the unit. The best basis for a consideration of maintainance costs in their proper economic light is one that will involve capacity as well as the rate and amount of work performed by the locomotive. Such, for instance would be a tractive effort-ton mile-hour basis.

The locomotive must be considered as an economic unit. In fact, is there any reason why each locomotive should not be treated as a separate unit and treated as a public utility corporation would treat each of its power plants? The original cost of the locomotive is known, the carrying charges are capable of determination, and the yearly cost of operation can and should be determined against the work performed in the way that good business demands.

The writer can not close without some reference to the type of publicity that has been given from time to time to some of the various proposed substitutes for the modern steam locomotive. Railroad men can not afford to deceive themselves regarding substitutes; neither should the public deceive itself. A substitute for the steam locomotive of the past is demanded not only by the exacting conditions of the present but by the still more exacting conditions inevitable in the future. The natural, sensible and logical substitute is the steam locomotive itself, improved in acordance with the knowledge, experience and vision that is now available.

Discussion

W. H. Flynn (M. C.): The vitality of the steam locomotive, instead of being on the wane, is increasing. That development, instead of having stopped, is still in progress and the possibilities of increased efficiency and capacity guarantee a continuing process, are most interesting and gratifying.

Naturally, with the necessity for more powerful locomotives, the various parts entering into the make-up of the machine have become heavier and larger. The refinements in design, many of which have been made possible by refinements in the materials used, have played an important part in bringing about the desired strength and durability without the proportionate increase in the size and weight, that might otherwise have been necessary. The development and application of many and various devices and appliances, tending to facilitate maintenance and to increase the power and efficiency, have all had a wonderful effect in advancing the serviceability and economy of the present day locomotive. The tables of comparison in Mr. Winterrowd's paper indicate nearly a 42 per cent. reduction in weight per indicated horsepower and an increase in the thermal efficiency of nearly 58 per cent., and all this has been accomplished within 13 years. What will be accomplished within the next 13 years, is, of course, problematical. Experiments are being conducted abroad with turbine locomotives. The development of the three cylinder locomotive, several of which are now in service in this country, and the development of a locomotive with a boiler carrying 350 lb. steam pressure.

with the possibilities which this and even higher pressures may permit to use steam expansively, will be accomplished to a greater extent than ever before in designs of locomotives by either compounding or otherwise. It would seem that we are well into another era of steam locomotive development which gives promise of wonderful accomplishments within the next few years.

I agree with Mr. Winterrowd that the locomotive must be considered as an economic unit and that for any economic consideration of the subject, maintenance cost based on the locomotive mile unit is not a reliable criterion.

It is true that the maintenance of a modern locomotive exceeds that of the old locomotive, but this is not an unreasonable expectation as the large locomotive of today has been built to haul more tonnage, and devices and appliances have been put on to increase capacity and efficiency. This combination results in an increase in maintenance work, but in return for this the locomotive gives back an increase in amount of work performed.

The steam locomotive represents an investment in the business of transportation, a going business that the life and prosperity of countries depend on. Transportation has become an exacting business, one that is under the observation of an exacting public, interested not alone in satisfactory service, but also in the performance of that service, efficiently and economically.

W. F. M. Goss: Thirty odd years ago, when No. 999 was in its prime, it was a common thought among locomotive designers, that the locomotive had reached its maximum of power. The argument sustaining such a belief ran substantially as follows: The fire box of a locomotive is its primary source of power. Unless the firebox can be made larger, the power of the locomotive cannot be increased. But the firebox must go between the wheels and its width cannot be further increased unless the gage of track is increased and its length must come within the spacing between the driving axles. This spacing cannot be further increased because coupling rods have already reached a maximum length for safety, and as a consequence of those limitations it cannot be expected that the locomotive will further increase in power.

Traditions vanished and a new day in locomotive design appeared. The locomotive testing plant was brought into commission and became a new source of information for the designer. Wheel arrangements multiplied, grate areas were increased enormously and locomotives have ever since been growing in weight, dimensions and power. Their efficiency has steadily improved. Comparing the performance of a modern locomotive with the locomotive first mounted on the Purdue testing plant 32 years ago, shows the power capacity to have increased six times or more. Steam consumption per unit power developed has diminished nearly forty per cent., and the coal consumption per unit power has been cut in half. These are some of the achievements of recent years.

If now in our moments of caution, we are inclined to raise a question as to whether we may not be going too fast or too far in some directions, the answer is clearly of record, in the results that are being secured. These results are something that we want, and we are willing to pay for them, and the added embellishment is but the pay that we give for them.

I quite agree with Mr. Winterrowd in his outlook upon the future. The process of developing new designs and of embellishing locomotives with devices for increase their usefulness is not approaching a conclusion but a new beginning. Locomotives have so grown around the grates which were made enormously large a quarter of a century ago, that relatively speaking the grates are no longer large. Many details influencing the process of combustion in their application to locomotive conditions must be restudied. Higher steam pressures are at hand. The further refinements of mechanism will have attention, and the certainty of action of every part of the machine will be increased. In fact, a perfect labyrinth of problems await to be solved before the locomotive of 1924 can be made ready to take its place at the head of a 1930 train.

And progress is no trivial matter. The fact must not be overlooked that in locomotive design we are dealing with factors involving enormous investments, both for construction and operation. Even the designer is not justified in any but the most conservative experimentation. The costs arising from research are heavy, yet research is necessary and the more we have, the faster we will go.

J. Snowden Bell: I want to impress upon the minds of the gentlemen present the last paragraph, which I would like to repeat. A substitute for the steam locomotive of the past is demanded not only by the exacting conditions of the present but by the still more exacting conditions inevitable in the future. The natural, sensible and logical substitute is the steam locomotive itself, improved in accordance with the knowledge, experience and vision that is now available.

In my opinion every proposition that is stated there so far as the matter of principle is concerned is correct, it is merely a matter of design to embody those well-established and correct principles in new construction. Taken in connection with the importance of fuel saving, which was so much stressed in the remarks of Mr. Aishton, it seems to me that to give attention to this last paragraph and to act upon it is the duty of every railroad mechanical officer.

Geo. S. Goodwin (C. R. I. & P.): Mr. Winterrowd has mentioned the superheater and the feedwater heater as important agents which have increased the capacity of the modern locomotive, but I did not notice that he mentioned the arch or the syphon. We have had considerable experience with the syphon and find that it, also, is an important factor in increasing the capacity of the locomotive.

C. E. Brooks (C. N. R.): There can be no question of the increase in thermal efficiency due to steam saving appliances and to improved boiler design which really means larger boilers. Instead of the general quality of fuel improving in the coming years, the tendency will be in the opposite direction, and railway officers will be forced to use poorer grades of fuels. The only way to keep up with this tendency is to build large capacity boilers with grate areas which will permit of low rates of combustion. These boilers should be backed up with those modern appliances which will help to extend their life and aid in fuel economy.

I refer particularly to the feedwater heater with which I believe every locomotive should be fitted. Before leaving the subject of boilers and boiler capacity, let me call attention to the fact that the desire for standardization often leads railways to duplicate orders for locomotives which have given general satisfaction. In doing this, it is frequently the case that advantage is not taken of improved practices, such as the use of alloy steels, which will permit the lightening of working parts. All this possible saving should go into more boiler and fuel saving appliances. During recent years, the manufacturers of materials entering into boiler construction have not improved their products materially, and outside of the size of plates there has been little progress. In order to keep up with the times, I believe that higher tensile boiler plate must be developed and that the day of iron stay

bolts is about over as steel of about 50 per cent greater strength is available and has passed out of the test period.

It is becoming apparent to many mechanical men that the railways do not get as much out of superheated steam as they should. This is a device that must be used to save coal, which means an engine worked to or near capacity. Considering the average monthly performance of a locomotive, it is remarkable how much time is spent under light load conditions which means low superheat and waste of fuel, all indicating that more consideration should be given to higher superheat. This will correct the tendency when working light for most of the hot gases to by-pass the superheater flues altogether.

The use of high-pressure steam in locomotive work has not yet been proved out to the point where it is safe for railways to jump into it without an extended test period to determine what it will mean in boiler work due to the relatively greater expansion strains which will be set up.

With regard to the increase of locomotive capacity by the use of the booster, I am thoroughly in accord with Mr. Winterrowd's statements, but I believe that the booster must be backed up by large boiler capacity to be anything more than a starting device. Modern appliances are not much use unless they are used to capacity. This means that not only should the locomotive be used near capacity conditions, but also that in times of business depression or seasonal slackness the modernized locomotive should be the one used and the old engine the one tallowed up for busy times.

Mention should be made of the possibility of the internal-combustion locomotive. Our electrical friends draw pictures of the day when the steam locomotive will pass out—possibly it will, but I suggest that when this happens it will be the internal combustion locomotive, mechanically driven and using the lowest priced distillates. This will prevent the electrical manufacturer from putting into effect much of their advertising. Great attempts will be made to add electrical equipment to the Diesel locomotive, thereby saving the field for the electrical forces, but this will not succeed in doing any more than delaying progress.

It is of the greatest importance that before power is built or rebuilt, a careful study be made of the condition under which the power will operate, making thorough allowance for the ever-increasing cost of roundhouse and road operation. When this study has been made, supplemented by the great experience and technical knowledge of the locomotive builders, the mechanical officer should decide on the design and the executives should encourage their efforts and study by authorizing them to build the locomotive which will have a maximum net earning capacity.

C. A. Seeley: The superheat feature has added greatly in point of capacity and reduced the monthly per unit expenditure of power. I would like to ask Mr. Winterrowd one question: Should not stationary boiler No. 4 read horizontal fire-tube boiler?

I think that in the addition of devices to the boiler, that the boiler proper in proportion to the fire box surface, in the heating area of the fire box proper, arches, syphons and devices to increase the efficiency of the boiler, is where the vital changes can be made.

Mr. Winterrowd: It seems to me that in connection with information of such nature there is but one way that it should be produced, and that is under conditions that will not permit of any question as to its accuracy or its reliability. "In the last analysis," quoting a prominent operating man relative to the steam locomotive, "it is a matter of return on the investment. What return can be obtained for the dollars spent? To date nothing has surpassed the steam locomotive in this respect."

H. H. Lanning, (A. T. & S. F.): The Santa Fe has one 2-10-2 Santa Fe type locomotive that is equipped with the four-wheel trailer truck. It has had this truck for more than four years. Its service during that time in practically every respect has been satisfactory, but we have found ways in which it can be improved and we are proceeding to do so. Even if we could not get a better truck than the one we have now I feel perfectly safe in saying that it should be used in cases where the load on the trailer will exceed what will be allowed for any given driver load, and possibly it should be used if the load does not get that high. It is commonly supposed that a four-wheel trailer truck introduces considerable ash pan difficulty. That is true to a certain extent. It is a little harder to work in an ash pan dump arrangement than it is with a single pair of trailer wheels. The total capacity of the ash pan, however, can be made greater due to the fact that you can use lower wheels and that the spring rigging does not take up so much space below the fire box. Altogether, I believe that the net result in regard to the ash pan is that we get a better one with the four-wheel truck than we do with the two-wheel.

The Three-Cylinder Locomotive

By J. G. Blunt
Mechanical Engineer, American Locomotive Company

The demand for greater tractive force, without increasing axle loads, has been a problem constantly presented to the locomotive builder. Materials suitable for use in highly stressed parts of the locomotive having much greater strength than formerly used are on the market, as well as various devices for effecting economy in the use of fuel, water and steam. These have done much to solve this problem in the past. A few locomotives have been built in the United States on the three-cylinder principle, but in nearly every case have been abandoned.

Normal Tractive Force

Starting heavy trains, ascending grades, as well as in the maintenance of maximum speeds, the locomotive is required to exert its maximum effort and this effort is obtained when the tractive force line fluctuates a minimum amount above and below the normal or straight tractive force line. This normal line is approached in direct proportion to the number of cylinder impulses per revolution of the driving wheel.

The normal tractive force line, regardless of the number of cylinders used, is half way between the maximum and minimum fluctuations; therefore, when the highest point of tractive force fluctuation in a two-cylinder engine is used as the base from which to figure the normal tractive force line in a three-cylinder locomotive, then this normal tractive force line rises and the tractive force for a given axle load is increased. It follows, therefore, that the coefficient of adhesion may be reduced proportionately without increasing the slipping tendency.

It will further be observed that while the normal tractive force line has been raised with the use of three cylinders, the low point of the tractive force curve in the case of the two-cylinder locomotive has raised doubly the amount of the normal tractive force line and this is the reason why the hauling capacity of a three-

cylinder locomotive increases so rapidly with the rise of its normal tractive force line over that of a two-cylinder locomotive.

Economy of the Three-Cylinder Locomotive

It is well known that car and locomotive journals at rest are more difficult to start than to keep in motion. A three-cylinder locomotive, with greater ability to start a train from rest and by reason of its similar ability after starting, enables the engineman to throw the engine after starting quickly into a shorter cut-off position than with the two-cylinder locomotive. Therefore, the three-cylinder locomotive delivers its tractive force with steam used more expansively than in the case of the two-cylinder locomotive, resulting in a more economical use of steam and a correspondingly less fuel consumption. We have, therefore, the means for obtaining in a steam locomotive the greatest tractive force for the least weight, accompanied by an unmistakable fuel economy.

A few three-cylinder locomotives have been built and tried out in this country and later abandoned. Many railroad men have felt, and not without apparent reason, that this type has proved a failure. However, the failures have undoubtedly been due to deficient and unreliable construction of those parts strictly involved in the three-cylinder application.

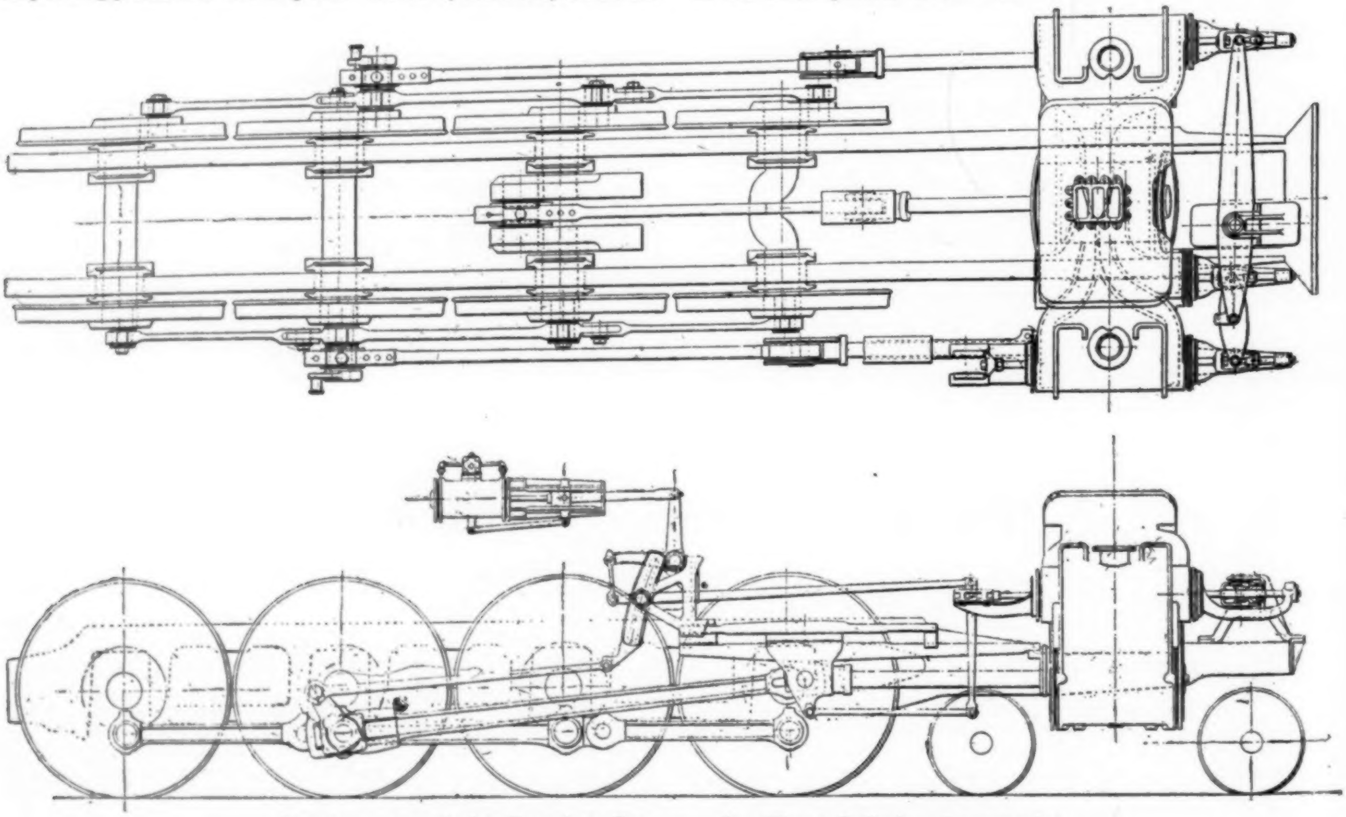
A three-cylinder locomotive has greater starting capacity than a two-cylinder locomotive of the same type. This feature enables the engineer to throw the engine into a shorter cut-off position quicker than he otherwise would with a two-cylinder locomotive. The total weights of the three-cylinder locomotive may be kept very close to that of the two-cylinder, still deliver a marked increase in tractive power and utilize the steam and fuel with greater economy. Its lighter reciprocating parts and correspondingly low dynamic effect permits operation at faster speeds.

J. G. Blunt

The three-cylinder locomotive being more economical in the use of steam and fuel, there follows a lesser boiler requirement. This condition is further improved by the more even draft on the fire resulting from the six exhausts per revolution of the driving wheels, which in turn permits the use of a relatively larger exhaust tip, with less back pressure.

The reasoning follows that the total weights of the three-cylinder locomotive may be kept very closely within those of the two-cylinder engine having equal axle loads and still deliver a marked increase in tractive force.

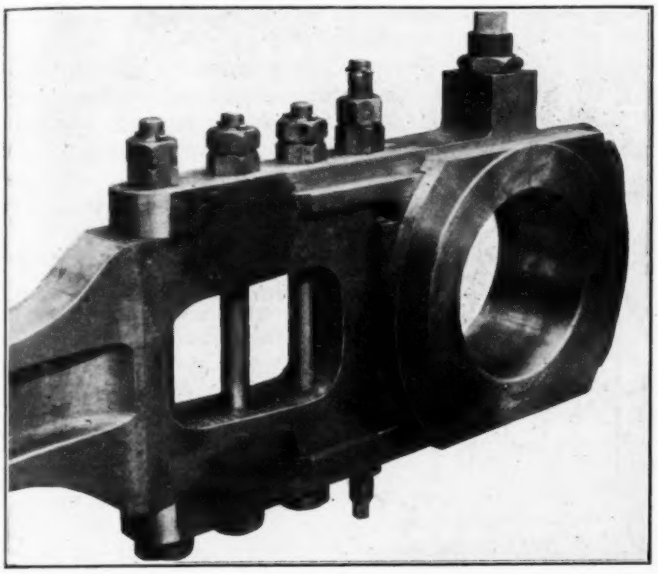
Each of the three cylinders is smaller than either of those in a two-cylinder locomotive and the reciprocating weights being balanced independently (the middle balance being applied to the crank axle disks and for each outside cylinder in the driving wheel), reduces the dynamic effect on the track of approximately 30 per cent, so that in a two-cylinder locomotive, while the dynamic effect may produce a maximum of 50 per cent over the static load at wheel speed there would be only 35 per cent in the case of the three-cylinder locomotive.



Arrangement of the Running Gear on the Three-Cylinder Locomotive

A locomotive of the three-cylinder type, reconstructed from a two-cylinder locomotive by the American Locomotive Company, and operating over a period of nearly two years, has shown a hauling capacity 50 per cent in excess of its performance prior to reconstruction, at the same time showing a fuel economy of from 10 per cent to 16 per cent.

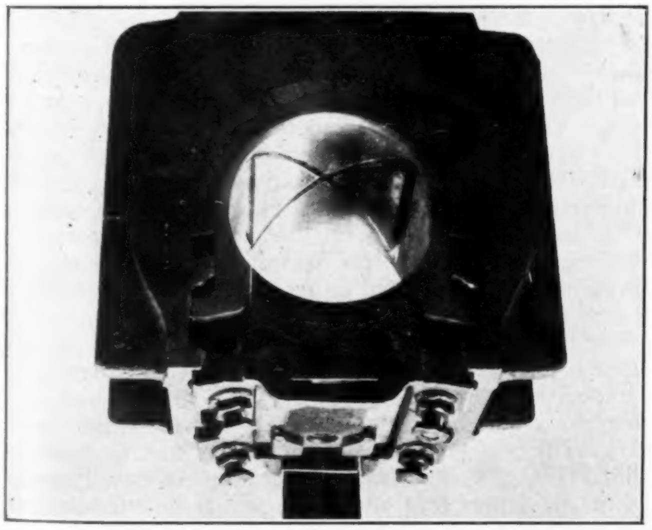
It follows further that the three-cylinder locomotive, by virtue of its lighter reciprocating parts and correspondingly less dynamic effect, should run faster. Confirming this assumption, a run was recently made with a three-cylinder locomotive built by the American Locomotive Company at approximately 12 per cent above



The Inside Main Rod

wheel speed, showing remarkable absence of vibration or nosing effects. This absence of vibration and nosing resulted from the combination of the three-cylinder principle with accurate leading and trailing truck resistances.

The above reasoning offers a solution for a larger steam locomotive unit without enlarging or increasing the right of way,



Type of Driving Box Used on the Crank Axle

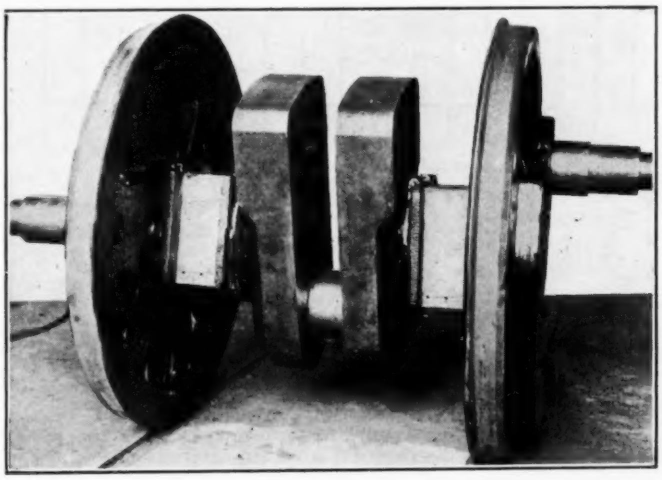
bridges or other structures, thereby providing means for moving a greater tonnage over an existing line, or moving the same tonnage over a line with a less number of locomotives. The abandonment of the valuable features which a three-cylinder locomotive offers has been due to deficient and unreliable construction of those parts strictly involved in the three-cylinder application. If the three-cylinder locomotive is to be a success, we must, of course, see that it is at least as reliable and as easily maintained as similar parts in the two-cylinder locomotive; in other words, the greater possibilities and utility of the three-cylinder locomotive have heretofore been given up, because of failure to master the details of construction.

It is said we have been working for years to get all working parts outside where they are easily accessible, and now the three-cylinder locomotive is proposed, bringing the old troubles back. All I can say is that when the Walschaert valve gear superseded the old Stevenson motion, no increase in tractive force and none of the advantages outlined were offered. With the third cylinder added, we offer increased power, speed and economy to offset the parts added by the third cylinder, and I feel sure that mature reflection will throw the balance infinitely in favor of the three-cylinder principle.

There is a real problem before us of the increased weight of parts, whether caused by the addition of devices to effect economies, those to meet other increasing demands, or increasing the weight of parts under stress for security against failure. These, as you are aware, have practically reached the limit and employing the three-cylinder principle seems to be a very practical way to meet these demands.

The Crank Akle

Simplicity of manufacture, together with better service reports, resulted in the adoption of the built-up axle, which facilitates balancing the reciprocating weights of the middle cylinder in the crank disks. Carbon-vanadium steel is used for all component parts of the built-up crank axle and grease lubrication is applied



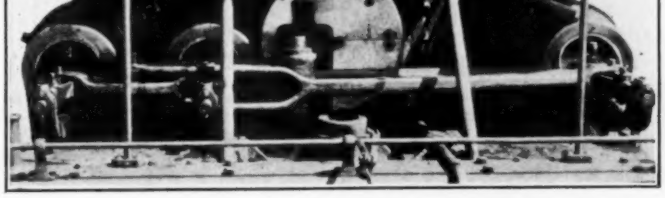
Crank Axle of the Built-Up Type

through the center of the axle to the crank pin, with grease plugs in the outer ends of the axle.

The Crank Axle Driving Box

A thorough analysis of the forces obtained in the three-cylinder application, together with the operating experience thus far gained, shows most beneficial results from the use of supplementary bearings on both sides of the journal and projecting from 2½ in. to 3 in. below the center of the axle.

A driving box spreader, open at the bottom and through which the grease is applied, is drawn into position to prevent the side of the box from closing in due to the cylinder thrust and in turn, pinching the journal brass on the axle with consequent heating of the journals.



Arrangement of the Valve Gear for the Middle Cylinder

The supplementary bearings, as well as the spreader, when once drawn into position, should not require removal until the wheels are dropped in order to perform work on the main journal bearings or boxes. The pedestal tie is curved downwardly sufficient to allow removal of the grease plate, thus overcoming any vibration and wear. The locomotive must of necessity be spotted with

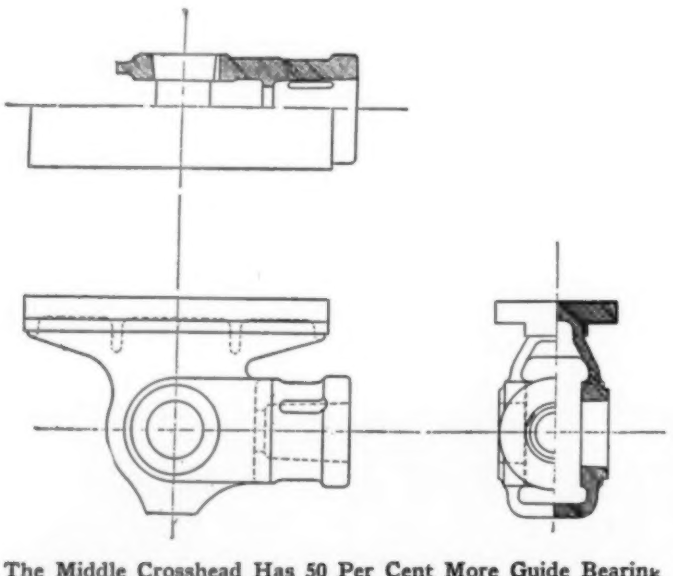
the crank disk approximately horizontal before removing the grease plate.

The Middle Main Rod, Valve Gear and Crosshead

The middle main rod may be of the strap or fork end style, the design and development of which have required most careful consideration on account of the angularity of the middle cylinder, as well as the large diameter of the crank pin. In addition to the lubrication through the center of the axle, grease plugs are provided on the rod.

The best service has resulted from the use of the three-bar type of crosshead having approximately a 50 per cent increase in the bearing surface over that used for either of the outside crossheads. The available clearance space readily permits of this increase and the desire to reduce maintenance to a minimum has been fully met by using this type of crosshead.

The lack of space in large locomotives, as well as the lesser number of parts and the desire to keep this gear outside where it may easily be gotten at, are the decisive factors on which the lever type of transmission was selected. This resulted in a combined movement of the two ordinary outside valve gears and having the characteristics of either outside gear.

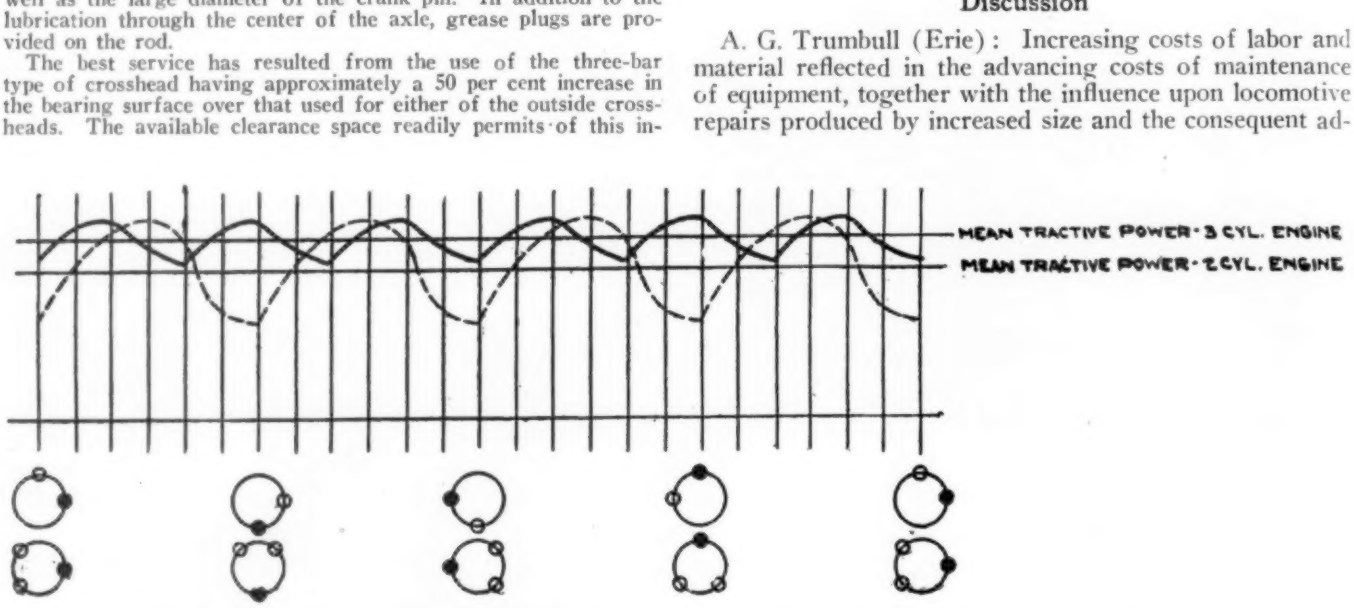


The Middle Crosshead Has 50 Per Cent More Guide Bearing Surface Than Either of the Outside Crossheads

Stresses in Rods and Axles

Much study has been given to the stress calculations in the rods and axles, the application of which, in the design of these parts, has worked out very successfully in service. The Lehigh Valley three-cylinder locomotive has the middle main rod connected on the second or crank axle and the outside cylinders on the third axle. This has the advantage of relieving a portion of the axle and rod stresses, as well as the tendency to reduce slipping of the wheels by reason of the slight lost motion in the bearings between the two pairs of wheels.

The driving axle just ahead of the crank axle usually requires about a 5-in. offset to clear the main rod when in its down stroke and by so doing, the usual spacing of wheels and cylinders is preserved as in similar types of two-cylinder locomotives.



Tractive Force Diagram—Full Lines are for the Three-Cylinder Engine and the Dotted Lines are for a Two-Cylinder Type; Main Rod Angles are not Considered

Discussion

A. G. Trumbull (Erie): Increasing costs of labor and material reflected in the advancing costs of maintenance of equipment, together with the influence upon locomotive repairs produced by increased size and the consequent addition of various auxiliaries, have stimulated recent studies in locomotive design and operation with a view to improved efficiency and maximum hauling capacity with a minimum coal and water rate consistent with the limitations imposed by current American practice and design.

This naturally has led to a return to the multiple-cylinder simple locomotive of which the recent three-cylinder type built by the American Locomotive Company for the Lehigh Valley is an example, and also to the development of the restricted cut-off locomotive built for the Pennsylvania. The simple Mallet locomotive of the Chesapeake & Ohio and the simple Decapod of the Pennsylvania appear to be peculiarly suited to relatively low-speed operation; while on the other hand the field of the three-cylinder locomotive would appear to lie particularly in the direction of fast freight and passenger service.

The three-cylinder locomotive described in Mr. Blunt's paper as well as other relatively recent examples have been confined to four-wheel engine truck construction. In order to avoid the use of short bi-furcated center main rods, to permit ample space for guides and to maintain cylinders in the same relative location, it would appear logical to expect that advantage would be taken of the greater distance between the center line of the cylinders and the first and second drivers, thus restricting future developments of the three-cylinder locomotive to those with four-wheel engine trucks. The increased weight at the front end also appears to make this advisable and would logically assign the greatest usefulness for locomotives of this type to relatively high speed service.

Other characteristics of the three-cylinder design, i. e.: uniformity in turning moment, reduction of dynamic augment, better balancing and increased tractive force possibilities without exceeding present track limitations naturally place it in this field.

The great advantage of the three-cylinder type lies in the greatly increased hauling capacity obtainable with relatively less weight on the drivers than is possible with

two-cylinder locomotives of equal capacity. This feature alone probably possesses sufficient advantage to justify an extension of the use of this principle regardless of any possible economy in fuel.

While Mr. Blunt's paper mentions an increase of 50 per cent. in hauling capacity as having been secured through the reconstruction of certain two-cylinder locomotives, it should not be too hastily concluded that similar increase of hauling capacity can be obtained in any locomotive through the relatively simple expedient of adding an additional cylinder. There are, however, many comparatively recent designs in which a substantial improvement in results could undoubtedly be so obtained.

Three-cylinder locomotives can not be expected to differ greatly in respect to fuel economy from the best designed modern two-cylinder locomotives. Some economy should be anticipated because of more uniform and less harsh exhaust thus producing a better draft and improved combustion which should permit a reduction in back pressure, but otherwise, the expansive use of the steam follows the characteristics of well designed two-cylinder engines.

The published results of the test of the Lehigh Valley locomotive should be considered with due reference to the limitations imposed by the usual road test. In these tests observations were made at an average speed of 19.9 miles and a maximum speed of 46 m.p.h, from which it is concluded that the minimum speed was substantially less than the average quoted. The water rate for a well designed two-cylinder Mikado locomotive at 30 per cent. cut-off and a speed of 30 m.p.h. should not exceed 17 lb. of water per indicated horsepower and for the same locomotive in full gear, at 15 m.p.h., should not exceed 27 lb. per indicated horsepower per hour. It can be seen that an average water rate based on these cut-offs and speeds do not furnish a wholly satisfactory basis for determination of expected economy. The average water rate obtained in the published tests give a rate per indicated horsepower per hour, less auxiliaries, of 19.6 lb., whereas at sustained speeds and fixed cut-off rates of 17 to 19 lb. are frequently obtained.

A comparison of the results of the Pennsylvania 50 per cent. cut-off locomotive under conditions fairly comparable with the three-cylinder locomotive test, indicates that at 19¼ m.p.h. with 50 per cent. cut-off, the water rate was 16.8 lb. per indicated horsepower per hour, while at 22.1 m.p.h. with 35 per cent. cut-off, a water rate of 15.5 lb. was obtained.

It appears that the fixed or restricted cut-off type of locomotive embodies a primary principle leading to steam economy, i. e., greater expansive use of steam. In this particular, the fixed cut-off engine has the characteristics of a two to one compound with a uniform turning effort markedly comparable with the three-cylinder engine.

There is an additional advantage in that only two sets of parts are required instead of three, and the maintenance difficulties with the three-cylinder engine introduced by the crank axle and the complications of the valve mechanism are eliminated.

The main objection to the fixed cut-off engine is the necessarily higher piston thrust involving increased weight of reciprocating parts and counterbalance. An engine of this type in high speed or relatively high speed service would be objectionable but at speeds required in ordinary freight service the difficulty is practically negligible.

It would appear from these considerations that the fixed or restricted cut-off locomotive would logically adapt itself to development for slow-speed freight service and the three-cylinder locomotive to high-speed passenger and freight service. It is probable that continued experience with locomotives of both classes will result in improved features of construction tending to minimize cost of maintenance and produce maximum serviceability. For these reasons the results from the use of both types of locomotives will be observed by motive power officers with increasing interest.

W. E. Cantley (L. V.): Mr. Blunt has very thoroughly covered the main features in design of the most recent development of three-cylinder locomotives in this country. There is little, if anything, that I can add regarding the particular features of design, but I can, at least, tell something of our experience with Lehigh Valley three-cylinder engine, No. 5000, here on exhibition.

This locomotive is of the 4-8-2 type, having a weight on drivers of 246,500 lb. and a maximum tractive effort of 64,700 lb. It was designed and built by the American Locomotive Company and turned over to the Lehigh Valley in October, 1923. Locomotive No. 5000 was placed in ordinary freight service on the Buffalo division as soon as received. The ruling grade on this division is 21 ft. to the mile and this locomotive had no difficulty in handling trains of 4,500 tons. Freight trains on this division had been handled by Mikado engines, but engine No. 5000 quickly demonstrated ability to handle considerably more tonnage than the Mikado and in much less time. After being in service on this division for several weeks an indicator test was made, together with coal and water readings, the results of this test being eminently satisfactory.

This locomotive, after the test, was tried out in our milk train service on the Seneca division east and Wyoming division, a distance of about 145 miles. The ruling grade eastward is 61½ and westward about 69 ft. to the mile. The milk train had previously been handled by Pacific type locomotives double headed. Going east the total tractive effort of the two Pacific type locomotives was 90,000 lb., and going west 97,000 lb. Engine No. 5000 was given a trial trip on this train alone and had no difficulty in making the time over the mountain.

Average timetable speed including schedule stops, east 34.3 m. p. h., west 27.2 m. p. h.; at times on the east bound trip we have average 39 m. p. h.

Up to that time no difficulty had been experienced with the locomotive, excepting that the front and back driving journals ran warm. No trouble whatever was experienced with either of the main driving journals, but the front and back journals had to be watched so carefully that it was finally decided to unwheel the engine and remove the cause of the trouble if possible. The builders did this work during February, 1924, smoothed up the journals, refitted the brasses and returned the engine. For the first trip or two, about March 7, 1924, the inside main rod ran a little warm but there was no further trouble with driving journals. Since that time we have had no trouble with heating of any kind. There has been absolutely no difficulty with respect to the middle cylinder, crosshead, guide or main rod. The engine is used regularly on this milk train making the division east one day and west the next day, running seven days a week on a run that we consider the hardest on the road. The engine has also been tried out in passenger service on the mountain, and while it has only 69-in. driving wheels, has had no difficulty in making schedule time. At 60 m. p. h. the engine is very smooth in operation, and has repeatedly made this speed. On one recent run with the milk train the average speed for 64 miles was 49 m. p. h. with 43 empty milk cars, about 1,500 tons.

From the standpoint of maintenance we feel we have little to fear. It is true that the engine has not yet been in service a year, but indications are that the maintenance

will be little, if any, more than an eight-coupled engine of the two-cylinder type having the same weight on drivers, and I am confident that the maintenance will not be as high as a two-cylinder capable of doing the same work. The design seems to be well worked out; no failures of any kind have occurred, and we have been well pleased with the success, not only from the standpoint of the motive power department, but also from that of the operating department.

A. H. Fetters (U. P.): When invited to contribute to the discussion on the three-cylinder locomotive I found in the proceedings—American Railway Master Mechanics' Association, 1913—a most complete discussion of the three-cylinder locomotive, in a remarkable paper by J. Snowden Bell, who introduced his subject in the following language, which today seems more or less prophetic:

"The three-cylinder locomotive, although originated as early as 1846, and applied in railroad service in 1847, has been confined to a smaller range of actual practice than any other design, which differs from the standard two-cylinder construction, and the record of its performance may, perhaps, be considered too limited to determine, with reasonable probability of correctness, whether its advantages are sufficient to recommend its general adoption. It does not, however, involve any error in mechanical principle, nor appear to have indicated objections in practice, and seems to the writer to be of sufficient interest and probable value to warrant a more careful and thorough consideration by locomotive designers and users than it has heretofore received."

While 11 years have elapsed since the above was written, the developments of the last two years appear partly to have verified Mr. Bell's prophecy.

In the various discussions on the three-cylinder locomotive, there seems to be fairly unanimous agreement as to certain desirable characteristics of this design; however, some doubt seems to center in the mind of the practical motive power and operating official about an increase of maintenance to be anticipated as a result of extra fundamental parts. This is natural, especially in view of past experiences with three-cylinder locomotives on American railroads. The probable increased maintenance of three-cylinder locomotives is a serious matter, and one that cannot be ignored in these days of highly competitive performance and operating costs.

We do not wish to bring into our locomotive assignment any type that requires more attention and repairs than our present conventional standards; however, past failure of the three-cylinder design may have been due to failure in mastering the details of construction.

The three-cylinder locomotive has, heretofore, not been successful largely because the time had not arrived when American designers had sufficient incentive to refine it into a mechanical success. Until recently, other and more conventional avenues were open by which to increase the power and capacity, but at the present time the field is largely exhausted, and we are now confronted with a serious problem if we desire to go further in power and capacity, inasmuch as we have about reached the permissible limits in clearances, wheel arangements, axle loads and power economizing auxiliaries. If at this juncture some one should state that he can produce 15 per cent. more tractive force, without increasing the weight on drivers, we are compelled to give the suggestion serious thought, even though it involves another cylinder.

On the question of relative maintenance of three-cylinder and two-cylinder locomotives, I wish to express a hopeful attitude, and I base my hope on two main postulates:

First—Locomotive maintenance, aside from boiler work is more or less a direct function of the number of parts used, especially moving and wearing parts, but it is also an inverse function of the magnitude of individual stresses and bearing pressures.

In the three-cylinder locomotive it appears reasonable to assume that these two functions can be made to cancel each other to the extent that final maintenance will not be increased; that is, if the duty on each vital part is reduced by one-third it can reasonably be expected to run one-third longer before requiring usual attention. This applies particularly to extra parts that are introduced by the three-cylinder design excepting valve motion, where the tendency appears to increase stresses by driving the third valve through the other two.

Second—Necessity will largely direct the energy and talent heretofore expended in developing mere size and strength, into the channel of design refinement, to the end that the three-cylinder locomotive may be made at least as reliable and economical in maintenance as the two-cylinder locomotive has been to date.

If the inside cylinder and related parts are not so accessible as would be desired, but if the advantages are fully demonstrated by practice, we will gradually find ourselves going through the old process of readjustment to new conditions, and arrange our shop facilities accordingly.

Such data as is available on the performance of the several recent three-cylinder locomotives is, in my mind, scarcely complete or sufficiently reliable over the comparatively short period of operation, to enable us to draw very definite conclusions in the way of comparisons with the best two-cylinder practice. Time and more engines in service with several cycles through the back shop will tell the story.

The three-cylinder locomotive does not appear to me to have all the advantages from the standpoint of design, particularly in view of the following considerations:

Assume that a given road is operating—let us say, a two-cylinder Mountain type locomotive, having the maximum allowable distributed and total weights, and that this locomotive has been carefully designed for the proper and best balance between boiler capacity and tractive power. If we attempt to replace this design with a three-cylinder one having the same total weight, we must immediately resign ourselves to relinquishing about 12,000 to 15,000 lb. of boiler metal to pay for the weight of the extra cylinder and parts. This brings the designer squarely up against the problem of insufficient boiler capacity. If we take 12,000 to 15,000 lb. from this boiler we must be assured that the reduced steaming capacity will be balanced by at least an equal economy in three-cylinder steam consumption. This can be done only by using a larger cylinder volume and shorter cut-off, involving more weight, which is added largely to the front truck.

Providing the original two-cylinder engine was designed to take advantage of the best relation between boiler capacity and tractive force, the problem of increasing the performance at all speeds under the same weight restrictions by substituting a three-cylinder design will become difficult. If the weight restriction is removed, the problem is simplified; however, the comparison will no longer be on a fair basis.

The three-cylinder problem with reference to fundamentals of design seems to sum itself up about as follows: Fixed maximum total weight; increased cylinder and machinery weight; consequent reduced boiler weight; reduced boiler capacity; necessary increased cylinder economy; increased tractive effort, up to a speed where the reduced boiler capacity takes effect.

Reasoning on this basis, the three-cylinder locomotive would be a very desirable and economical type for low speeds where a high maximum tractive force was desired and full boiler capacity seldom reached. On the

same basis of reasoning it would not be possible to obtain quite as much sustained maximum horsepower or drawbar pull from the three-cylinder locomotive at high speeds as from an equally well designed two-cylinder type, although fuel economy should favor the three-cylinder throughout the entire range of speed and work.

J. A. Pilcher (N. & W.): In thinking over the problem recently I had in mind a combination of the three-cylinder arrangement with the limited cut-off. With the limited cut-off applied to the three-cylinder engine we will get the advantages of the three-cylinder engine with the starting capacity, along with the advantages of the limited cut-off engine with corresponding economy. This would, in a measure, due to the necessary increase in the size of the piston on the limited cut-off engine, affect, to a certain extent, the dynamic augment, but at the same time it would not be as great as with the two-cylinder engine.

Mr. Blunt: I would like to make one or two points clear. While I mentioned the fact that a New York Central locomotive had increased its capacity 50 per cent, I wish to say that if the co-efficient of adhesion at the high point of the tractive effort in the two types of locomotives were the same, that the low point of the two tractive power lines or curves in the case of the two-cylinder, calling that one hundred per cent, the hauling capacity at the low point of the curve would have been raised 36 per cent, so that you get really an engine of the same factor of adhesion at the top point of the curve, you have an increase in hauling capacity of 36 per cent. I make that explanation because in the case of this New York Central engine it had a high factor of adhesion, and that was reduced to the equivalent in a two-cylinder engine, or 4.25 normal factor of adhesion, which is the common practice.

As to the types of locomotives to which the three-cylinder principle can be applied, I would say that we have already built five engines for use on the Manchurian railway of the Mikado type, and I would say that the three-cylinder principle applies just as well to three, four or five coupled wheels with the two- or four-wheel engine trucks. We have now under construction a Pacific type for the Rock Island which will be the first one of the type. I would further say that in the case of the Mountain types it lends itself more perfectly to the application of this principle because you can attach the middle cylinder to the second pair of wheels and the two outside ones to the third, and in that way reduce the rod stresses and distribute the power on the two axles.

J. Snowden Bell: I think Mr. Blunt might answer the suggestion made by the preceding speaker as to the combination of the 50 per cent cut-off and the three-cylinders. It occurred to me some time ago and I would like to know what Mr. Blunt thinks of it.

Mr. Blunt: As to this point I would say that we have considered it and that was one of the first considerations that we had in mind when designing the first three-cylinder engine. It was just as applicable to the three-cylinder principle and the same advantages may be obtained by applying the three-cylinder principle, getting the advantages of that, plus the 36 per cent I spoke of, making it into the three-cylinder engine.

Mr. Harris (A. T. & S. F.): Mr. Aishton has just cautioned us that the most potent factor before us today is economy. The paper has dealt on economy in operation, tonnage and fuel but nothing has been said relative to the maintenance cost at the roundhouse. We know from experience that the first cost of a built-up crank axle is high and also maintenance due to wearing out of round and wheel centers becoming out of gage. We have found 200,000 miles has been a safe limit on axles due to breakage. Also the application of the valve gear on this type of locomotive is going to make it very slow on turning at the roundhouse, also due to the eight different bearings which will no doubt wear excessively. Also, the application of the valve and packing is going to make it expensive due to the amount of material that will have to be moved before we can get to the part desired.

I move that this convention show its appreciation by a rising vote of thanks, and that Mr. Blunt's report be printed in the minutes of our meeting.

(*A rising vote of thanks was given Mr. Blunt and the paper ordered printed in the Proceedings*).

Sykes Motor Train Makes Long Run To Atlantic City

One of the interesting features of the track exhibit on Mississippi avenue is the Sykes two-car gasoline motor train which made a trip of about 1250 miles from Oelwein, Iowa, to Atlantic City in four days under its own power, as mentioned briefly in Thursday's *Daily*. This train has been in regular main line local service on the Chicago Great Western between Des Moines and Waterloo, Iowa, for the past 10 months, having made during that time approximately 50,000 miles. It was loaned to the Sykes Company, the manufacturer, through the courtesy of the Chicago Great Western for purposes of exhibition at the convention.

Some of the details of the trip may be of interest. The train was taken out of service at Waterloo and, after an inspection which showed no repairs to be necessary, it was sent to Chicago, a distance of about 230 miles. From Chicago the train was routed over the Baltimore & Ohio through Youngstown and Baltimore to Philadelphia. It then proceeded over the Philadelphia & Reading to Atlantic City, a total distance of 990 miles from Chicago.

The crew of the train consisted of a single operator furnished by the Sykes Company, and a pilot, conductor and flagman, provided by the roads over which the train passed and changed at each division point. The train left Chicago at 10:10 a.m., Sunday, lying over one night at Youngstown and another at Baltimore. It arrived at Atlantic City on Tuesday at 6 p.m.

The run from Chicago to Youngstown, a distancee of 406 miles, was made at an average speed of 40.6 miles an hour actual running time. No unusual incidents happened on the way. A stop of 57 minutes was made at Garret, Ind., for lunch and to take on gasoline and oil, arrangements having been made in advance for fresh supplies at division points. The run from Youngstown to Baltimore, a distance of 418 miles was made on the second day in 11 hours and 48 minutes, with 1 hour and 29 minutes out for meals and supplies. This run was over the mountains, a large portion of the distance being upgrade. For example, the run from Connellsville to Sand Patch—50 miles—was almost continuously upgrade from an elevation of 800 ft. at the former points to 2,200 ft. at the latter. The average speed was 38.1 miles an hour, actual running time. No excessive heating of the motor was observed at any time during the trip. The distance from Baltimore to Philadelphia, 95.9 miles, was made on the third day in 2 hours and 6 minutes at an average speed of 45.7 miles an hour. Most of the afternoon was taken up in getting through the yards at Philadelphia, ferrying across the river and passing the yards at Camden. The train arrived at Atlantic City at about 6 p.m.

A record of gasoline consumption was kept between Chicago and Atlantic City, 292 gal. of gas used, or an average of 3.75 miles per gal. This is a slightly more favorable showing than is secured on the Chicago Great Western, owing to the decreased frequency of stops on

the trip and the very great reduction of gasoline consumption while standing at stations. The oil consumption during the trip was about one pint for every 17 miles.

The Sykes Company entertained numerous guests, including railroad officers and others interested in gasoline railway equipment, during this trip. E. Wanamaker, electrical engineer of the Rock Island, made the entire trip from Chicago to Atlantic City. O. H. Nance, president of the Maryland & Pacific, rode the train from Connellsville, Pa., to Baltimore, Md. A large number of representatives of the Baltimore & Ohio made the trip from Baltimore to Philadelphia. The officers of the Sykes Company who were present included C. E. Sykes, president; Charles S. Lynch, secretary and treasurer; M. P. Winther, vice-president; A. M. Russell, vice-president, and C. A. Sattley.

The Sykes train is powered with a Sterling six-cylinder motor developing 240 h.p. at a speed of 1,700 r.p.m. It has dual valves, triple ignition and two carburetors. No motor troubles developed during the trip and at no time did the red show in the Motormeter circle.

Because of the fact that the Chicago Great Western desires to return this train to service at an early date only 10 days could be allowed for the exhibition and trip both ways between Oelwein and Atlantic City. The train will probably leave on Saturday evening for the return trip.

C. M. & St. P. Locomotive On Exhibit

One of the Chicago, Milwaukee & St. Paul electric locomotives is on exhibit at the track three blocks west of the pier. This locomotive was built by the General Electric Co. It has been in service about four years and has operated approximately 350,000 miles. It weighs 265 tons, with a horse-power of 3200, and is capable of a speed of 65 miles per hour.

Pennsylvania Promotions

Several changes which affect motive power men on the Pennsylvania have just been announced.

E. W. Smith, general superintendent of motive power, Southwestern Region, has been promoted to general superintendent, Western Pennsylvania Division.

F. G. Grimshaw, superintendent motive power, Eastern Ohio Division, has been promoted to general superintendent motive power, Southwestern Region.

R. G. Bennett, superintendent motive power, Central Pennsylvania Division, has been promoted to superintendent motive power, Eastern Ohio Division.

E. B. DeVilbiss, master mechanic, Eastern Division, has been promoted to superintendent motive power, Central Pennsylvania Division.

J. Austin Sheedy, assistant master mechanic of the Meadows shops, Jersey City, N. J., has been made master mechanic of the Eastern Division, Central Region, with headquarters at Allegheny, Pa.

R. S. M. A. Officers Nominated

The Nominating Committee of the Railway Supply Manufacturers' Association last evening made its report to the association. The following were the unanimous choices for officers for the coming year:

President, Leroy S. Wright, National Malleable & Steel Castings Company.

Vice-President, W. H. S. Bateman, Parkesburg Iron Company.

The Nominating Committee consisted of Frank J. Lanahan, chairman, J. G. Platt, E. H. Walker, J. R. Blakeslee, J. Will Johnson, Charles R. Long, George E. Howard and Joseph A. Cameron.

Registration, American Railway Association

Division V—Mechanical

Adkins, J. E., M. M., B. C. & A., Craig Hall.
Aishton, R. H., President, A. R. A.
Allen, L. L., M. M., Gulf Coast Lines, Haddon Hall.
Andrews, S. B., Mech. Engr., C. & O., Traymore.
Appler, A. B., M. E., D. & H., Marlborough.
Baldwin, T. C., M. M., N. Y. C. & St. L., Ritz-Carlton.
Barrett, C. D., Asst. Eng. Tests, Pennhurst.
Bauer, F., M. M., C. C. C. & St. L.
Baumbush, Albert J., Asst. G. F., N. Y. C., Pennhurst.
Beamer, J. A., M. M., Penna., Chalfonte.
Bebout, G. W., E. E., C. & O., Traymore.
Bennett, R. G., S. M. P., Penna., Haddon Hall.
Berg, Karl, Supt. Loco. Shops., P. & L. E., Pennhurst.
Billan, L. S., Asst. Elec. Eng., B. & O., Haddon Hall.
Bingaman, Chas. A., M. E., P. & R., Bothwell.
Bishop, J. C., S. M. P., L. I., Chelsea.
Bissett, J. R., Mech. Insp., S. A. L., Chelsea.
Bonhoff, E. L., G. F., Penna.
Borell, E. A., Eng. M. P., P. & R., Bothwell.
Boulineau, W. W., M. M., C. of Ga., Haddon Hall.
Bower, John R., C. I., P. & R.
Bracken, J. L., Engineering Asst., N. Y. N. H. & H., Traymore.
Breaker, E. R., S. M. P. & M. of W., C. A. U. & G., Haddon Hall.
Bristoll, Chas. H., Apprentice Class Instructor, C. N. R., Strand.
Bronson, C. B., Mech. Eng. Off. Cons. Eng., N. Y. C., Strand.
Budwell, Leigh, Mech. Eng., R. F. & P., Runnymede.
Burklay, H. J., M. M., B. & O., Schlitz.
Burnham, W. D., G. F., B. & O., Castor.
Butler, Jas., M. M., Ann Arbor, Dennis.
Byron, A. W., M. M., Penna., Marlborough.
Cafferty, W. A., M. M., C. of Ga., Traymore.
Caley, G. H., Elec. & Sig. Eng., N. Y. O. & W., Shelburne.
Carmer, J. R., Ret. G. F., Penna., Ritz-Carlton.
Carmody, J. A., Supt. Elec. Equipment, N. Y. C., Shelburne.
Cartwright, D. J., Supvr. Car Lgt., L. V.
Chaffin, H. B., M. M., Penna., Fredonia.
Cheesman, P. M., M. M., Penna., Watkins.
Clark, Ed., M. M., Cornwall, Arlington.
Colcord, W. J., Spec. Eng., W. J. & S. S., Elmore.
Connelly, F. J., Secy. to Pres., N. W. P.
Cooper, F. E., Supt. Shops, B. & O.
Cooper, W. E., Insp., Bureau Explosives A. R. A., Dennis.
Coutant, W. R., M. M., U. & D., Shelburne.
Cox, N. F., Asst. Supt. Mach., L. & N., Chalfonte.
Cox, E. L., Asst. M. M., C. of Ga., Traymore.
Crabbs, W. J., M. E., W. M.
Craig, E. J., M. M., O. & W., Haddon Hall.
Crandall, Bruce V., Editor, C. & N. W.
Crawford, D. F., Brighton.
Cressman, Francis W., Asst. Foreman, P. & R.
Cromwell, E. G., Spec. Inspector, B. & O., Haddon Hall.
Cromwell, Oliver C., Asst. to Ch. of M. P. & E., B. & O., Strand.
Daley, J. H., Mech. Supt., N. Y. N. H. & H., Chalfonte.
Daley, W. W., M. M., N. Y. O. & W., Shelburne.
Dampman, Chas. P., Supvr. Fuel Cons., P. & R.
Dapus, G. T., Mech. Supt., Erie, Haddon Hall.
Davis, J. H., Elec. Eng., B. & O., Shelburne.
Davis, M. J., Eng. M. P., Penna., Shelburne.
Davis, M. L., M. M., N. Y. C., Haddon Hall.
Davis, W. H., Mech. Eng., C. & M., Haddon Hall.
Day, J. C., G. F., Penna.
Dellert, W. H., M. M., N. Y. N. H. & H., Windsor.
Dildine, E. E., G. F. L. D., Penna., Traymore.
Dooley, W. J., G. F., N. Y. N. H. & H., Richmond.
Douglass, F. W., M. M., Atlanta Joint Terminal, St. Charles.
Dunham, W. E., Supt. Car Dept., C. & N. W., Knickerbocker.
Dwyer, E. J., Secy. to Pres., A. R. A., Marlborough.
Edmondson, W. G., Asst. Eng. M. P., P. & R., Brighton.
Elmer, Wm., Supt., Penna., Traymore.
Embury, W. B., M. M., C. R. I. & P., Strand.
Evans, W. M., M. M., C. & O., Marlborough.
Everett, Ira, Ch. C. Insp., L. V., Dennis.
Farr, B. J., S. M. P. & C. D. G. T. W., Marlborough.
Feeley, M. R., M. M., D. L. & W., Knickerbocker.
Force, H. J., Eng. Test, D. L. & W., Traymore.
Galloway, A. K., M. M., B. & O., Haddon Hall.
Gilbert, J. B., Sr., Foreman, Penna.
Goings, C. E., Sig. Eng., Penna.
Graver, Harry, Eng., P. & R.
Gross, E. G., M. M., A. & W. P., Chelsea.
Gurnee, Wm. H., Genl. Car For., C. N. E., Haddon Hall.
Hamilton, J. T., M. M., N. Y. W. & B., Ambassador.
Hamm, W. C., Mech. Eng., C. Vt., Craig Hall.
Hardy, R. A., P. & R., Elberon.
Hassett, J. C., M. E., N. Y. N. H. & H., Traymore.
Hazel, J. F., S. M. P. & E., D. & T. S. L., Shelburne.
Hedeman, Walter R., Ch. Draftsman, B. & O., Dennis.
Henley, R. G., Asst. to S. M. P., N. & W., Marlborough.
Henry, C. L., Asst. M. M., Penna.

Hodges, A. H., M. M., B. & O.
Hogan, P. J., G. F., N. Y. N. H. & H., Colonial.
Hoke, H. A., Asst. Mech. Engr., Penna.
Hughen, J. M., Strand.
Humburch, R. S., Gen. Mech. Eng., Mer. Desp. Trans., Shelburne.
Humphlett, W. R., M. M., C. N. & L., Lyric.
Hurd, R. S., Spec. Agt. East. Reg., Penna., Traymore.
Irvin I. B., M. M., P. S. & N., Terminal.
Jacob, Wm., Mech. Eng., P.M., Haddon Hall.
Jaynes, R. T., M. M., L. & H. R., Chalfonte.
Johnson, Geo. T., Elec. Eng., N. Y. N. H. & H., Shelburne.
Knapp, Arthur, Asst. to Con. Eng., N. Y. C., Strand.
Kapp, J. B., M. M., Penna., Knickerbocker.
Kennoy, R. P., V. P., Donova, Southern, Dennis.
Knight, W. G., Mech. Supt., B. A. R., Chalfonte.
Lamberg, G., Shop Supt., C. M. & St. P., Ambassador.
Lambeth, C. L., S. M. P. & C. E., M. & O., Breakers.
La Porte, J. C., G. F., Penna., Sterling.
Lerch, G. P., Air Brake Spvr., P. & R.
Linderman, F. A., S. M. P., N. Y. C., Dennis.
Link, A., M. M., M. C., Traymore.
Love, John, Asst. M. M., C. of N. J., Lyric.
Mason, J. H., R. F. E., C. of N. J., Lyric.
McCarty, R. J., Mech. Eng., D. & H., Ambassador.
McCloskey, C. E., M. M., Gulf Coast Lines, Haddon Hall.
McGahey, R. E., M. M., R. F. & P., Dennis.
McGee, W. A., Mech. Engr., N. Y. C., Ambassador.
McManamy, Frank, I. C. C., Marlborough.
McVey, Col. J. W., S. M. P., Cub. Rys., Seaview Golf Club.
Meyer, A. C., G. F., N. Y. N. H. & H., Fredonia.
Michael, J. B., M. M., Southern, Princess.
Minick, J. L., Asst. Engr., Penna.
Moler, A. L., Mech. Insp., C. & O., Haddon Hall.
Moses, F. K., M. M., B. & O., Fredonia.
Mulheim, L. C., Ch. Hdlt. Supvr., B. & O., Craig Hall.
Murphy, J. W., G. F., B. & A., Ritz-Carlton.
Nance, O. H., Pres. & G. M., Md. & Penna., Ambassador.
Nelson, Wm., M. E., K. C. S., Ambassador.
Ott, William B., M. M., Penna.
Overdorff, C. A., G. F., Penna.
Parker, H. H., M. M., N. & P. B. L., Princess.
Parker, Wm., Jr., Asst. M. M., Penna., Elberon.
Palmer, W. S., President & G. M., N. W. P.
Persons, C. C., M. M., A. B. & A., Princess.
Peterson, T. E., Asst. to Mech. Eng., B. & A., Shelburne.
Pfahler, F. P., M. M., B. & O., Marlborough.
Pinkerton, H. W., Asst. Eng., N. Y. C.
Pierce, J. M., M. M., K. C. S., Ambassador.
Polk, W. U., Supt. of Repairs, B. C. & A., Craig Hall.
Porter, J. B., G. F., N. Y. N. H. & H., Continental.
Ralston, A. L., Mech. Supt., N. Y. N. H. & H., Shelburne.
Rasbridge, R. B., Supt. C. D., P. & R., Ritz-Carlton.
Rashba, J. S., Asst. to Engr. Tests, N. Y. N. H. & H.
Rauschart, E. A., Mech. Supt., Montour, Princess.
Reed, Merle R., M. M., Penna., Breakers.
Reese, O. P., Asst. G. S. M. P., Penna., Traymore.
Rhoads, G. A., M. M., Penna., Breakers.
Rice, W. L., Shop Supt., P. & R., Dennis.
Robb, E. H., Asst. Mech. Eng., L. I., Dennis.
Robinson, W. L., Supt. Fuel & Loco Perf., B. & O., Runnymede.
Roderick, M. B., Supvr. Tools & Machinery, Erie.
Romig, Jno. S., Asst. M. M., Penna., Morton.
Saltzer, J. L., For. C. Rep., P. & R.
Seddon, E. F., Genl. Mach. For., L. V., Shelburne.
Seidell, Frank M., Air Brake Insp., P. & R., Beaumont.
Sisco, G. E., M. M., Penna., Breakers.
Sheehan, J. E., G. C. I., N. Y. N. H. & H., Pennhurst.
Sheehan, J. F., Mech. Eng., A. B. & A., Haddon Hall.
Shepard, C. E., Pennhurst.
Sloan, J. R., Ch. Elec., Penna., Marlborough.
Simons, A. M., R. F. of E., P. L. & N., Terminal.
Small, J. W., Ch. Mech. Officer, C. & O., Haddon Hall.
Smeltz, M. J. H., Supvr. Elec. Head., B. & O., Ambassador.
Smith, L. K., M. M., Wabash, Bretton Hall.
Smith, Wm., G. F., P. & L. E., Pennhurst.
St. Clair, J. T., Eng. of Car Const., A. T. & S. F., Ambassador.
Stark, D. A., G. F., L. V., Shelburne.
Sugg, C. R., E. E., A. C. L., Ritz-Carlton.
Thompson, J. G., M. M., L. V., Monticello.
Thompson, D. B., Asst. Eng., N. Y. C., Shelburne.
Thompson, N. N., G. F., N. Y. N. H. & H., Continental.
Tutt, T. L., Strand.
Van Gundy, C. P., Water Eng., B. & O.
Voigt, A. E., Car Lighting Eng., A. T. & S. F., Chelsea.
Wakeley, G. B., Asst. Eng., N. Y. C.
Wardwell, F. N., Asst. Engr., N. Y. C., Strand.
Warren, L. C., G. M., Susquehanna & New York, Craig Hall.
Wells, A. P., Eng. of Tests, C. of Ga., Shelburne.
Westbrook, M. H., Supt. C. N. R., New England.
White, A. K., Marlborough.
Whitehurst, S. A., M. M., C. of Ga., Traymore.
Whitsitt, W. B., Asst. Mech. Eng., B. & O., Shelburne.
Whyte, Arthur, Ambassador.
Wiles, J. F., M. P. Insp., B. & O., Knickerbocker.
Wilson, J. H., Ch. Elect., N. S., Runnymede.
Williams, Ernest V., S. M. P., B. R. & P., New England.
Wintersteen, J., G. M., Cornwall, Arlington.
Woods, C. R., Asst. S. M. P., P. M., Chalfonte.
Winship, L. C., Elec. Supt., B. & M., Chelsea.
Wray, F. W., M. M., Penna., Strand.
Young, Paul, G. F., Cornwall, Arlington.
Young, James, Jr., W. J. & S. S., Strand.
Zimkowski, F., Gel. Supr. Car Light., N. Y. N. H. & H., Colonial.

Division VI—Purchases and Stores

Bowers, Samuel D., Ch. Cl. Pur. Dept., B. & O., Strand.
Hanlon, F. J., Storekeeper, Penna.
Hughes, P. E., Comm. Agt. Pur. Dept., Penna., Apollo.
Jackson, J. C., C. S. G. T., Ambassador.
Scott, G. E., P. A., M. K. & T., Traymore.
Walther, E. W., Asst. to P. A., B. & O., Strand.
Wright, C. L., G. S., M. K. & T., Traymore.

Special Guests

Ardis, L. T., For., Penna.
Armbruster, Robert, Ch. Elec., Million Dollar Pier.
Barfoot, H. F., C. & N. W.
Barkman, George A., C. C. C. & St. L.
Bartlett, Jno. J., Jr., Act. Insp. M. P. Dept., L. I., Melburn.
Barton, E. O., For., Penna.
Baumbush, A. J., Asst. G. F., N. Y. C., Pennhurst.
Beck, J. H., Air Brake For., C. of N. J., Edison.
Becker, Howard W., Trav. Frt. Agt., P. & R.
Booth, Robert S., Federal Inspr., I. C. C., St. Charles.
Boyer, John O., Asst. R. F. E., P. & R., New England.
Briggs, J. H., Asst. For., P. & R.
Broomall, J. H., Penna., Elwood.
Bruckert, R. H., Storekeeper, K. & I. Terminal, Shelburne.
Bryon, R. J., Penna., Marlborough.
Buckley, Wm., Air Brake Insp., S. M. P., Penna.
Burkley, H., B. & O., Schlitz.
Cannon, J. M., Mgr. ret., The Pullman Co., Bouvier.
Chaffin, H. R., Jr., Fredonia.
Chew, W. B., Pass. Dept., Penna.
Clouser, Harry C., Asst. For., P. & R.
Cook, E. R., Pass. Dept., W. J. & S. S.
Copell, Henry A., For., N. Y. N. H. & H., Colonial.
Corson, R. H., Asst. Supt. of Tel., Erie, Haddon Hall.
Cade, W. E., Jr., Secy. New England R. R. Club, Shelburne.
Cathcart, H. W., Fuel Insp., P. & R.
Cornell, J. Albert, Am. Ry. Exp.
Croft, J. M., Asst. Supv. Frt. Mov., Penna.
Dildine, E. E., Supt. of Tel., N. P., Chalfonte.
Donnely, C. J., Am. Ry. Exp.
Duerr, J. N., Dennis.
Dunn, J. C., Eng., C. N. R.
Eibler, P. W., Insp. M. P. Dept., L. I.
Ermentrout, Geo. J., Insp. of Motor Cars, P. & R., Bothwell.
Gallagher, Thomas M., Dist. Frt. Agt., B. & O.
Galloway, D. M., Shelburne.
Gledhill, E. S., Dining Service, N. Y. C., Harris Apt.
Gorman, J. C., Supt., McKeesport Connecting, Galen Hall.
Gott, Frank, Supt. Car Works, Prudential Oil Corp., Strand.
Graham, Chas., Lexington.
Grant, Harry.
Hill, E. P., For., C. of A., Traymore.
Hillebrand, W., Car Lighting For., C. of N. J., Galen Hall.
Hood, G. D., Supt. Tel., C. R. I. & P., Haddon Hall.
Hummel, Albert M., Machinist, P. & R., Somerset.
Huttle, J. L., Asst. For. M. P. Dept., L. I.
Itow, S., M. E., Southern Manchuria, Chelsea.
Jones, S. L., R. F. E., Penna.
Jost, J. William, Draftsman, P. & R.
Kane, J. P., Master Blacksmith, B. & O., Schlitz.
Kilborn, James E., P. A., Rutland, Shelburne.
King, J. H., Ch. Cl., N. Y. O. & W., Craig Hall.
Kleber, W. C., For., C. of N. J., Adison.
Klockers, C. P., Draftsman, C. of N. J., Shelburne.
Koyama, Twae, Rep. Japanese Govt. Rys., Chelsea.
Lindsay, C. C., B. & O., Wyoming.
Lohman, C. H., For., C. of N. J., Adison.
Lowe, C. I., Secy. to Ch. M. P., B. & O., Haddon Hall.
Mawrer, Chas. P., R. H., P. & R.
McCarty, C. E., D. & H., Ambassador.
McGary, A., Ch. Elect., N. Y. C.
McDonald, N. J., Matl. Supvr., W. J. & S. S.
McIntyre, Jas. J., Asst. R. H. F., C. of N. J., Adison.
McManamy, Frank, I. C. C., Marlborough.
Martin, J. J., R. H. F., C. of N. J., Adison.
Merrill, A. J., Secy., S. & Southwestern Ry. Club, Room 315, Dennis.
Miller, L. F., R. F. Elec., C. & O., New Belmont.
Morris, H. R., Asst. Eng., N. Y. N. H. & H., Haddon Hall.
Morris, Harry, Royal Palace.
Nagaya, T., Works Mgr., Japan Car & Loco. Co., Chelsea.
Namba, H., Ch. Elec. Eng., Japanese Govt. Rys., Chelsea.
Nelson, C. W., Supv. Train Control, C. & O., New Belmont.
Paight, J. T., Gen. Insp., N. Y. N. H. & H., Traymore.
Parker, Frank, R. H. F., B. & O., Traymore.
Patchel, Robert E., Elec. M. P. & R. E. Dept., Atl. City.
Patterson, W. J., Asst. Dir. Bureau of Safety, I. C. C., Elberon.
Pearse, J. B., Asst. Genl. For., P. & R.
Pfahler, F. P., Jr., Marlborough.
Peterson, C. W., Elec. Insp., N. Y. C.
Peterson, H. H., For., P. & R., Somerset.
Post, R., Asst. For., C. of N. J., Terminal.
Powell, W. T., Asst. Yard Master, Penna.
Prettyman, Alex. J., For. Elec., N. Y. C., Colonial.
Pribble, B. S., Ch. Cl. S. M. P., R. F. & P., Runnymede.
Purinton, A. J., V. P., Atlantic City & Shore.
Raub, Frank H., Supvr., A. C. & S. S.
Rause, Wm.
Reed, G., Termil. For. M. P. Dept., N. Y. C., Haddon Hall.
Robinson, W. L., Jr., Runnymede.
Ruegar, H. A., For., L. I.
Saito, Isamu, Rep. Japanese Govt. R. R., Chelsea.
Saylor, H. B., P. & R.
Scheirer, Russell H., Cl., L. & N. E., Haddon Hall.
Schwanke, E. C., Stores Dept., W. J. & S. S.
Seaman, J. P., Asst. to Supvr. Frt. Mov., Penna.
Shimaski, K., Osaka Loco. Works, Chelsea.
Smith, Chas. E., Fuel Insp., P. & R.
Tomlinson, I. N., Ch. Cl. Tele. Dept., Wabash, Haddon Hall.
Urie, J. B., Asst. For., C. of N. J., Edison.
Wall, George, Elec. For., D. L. & W., Colonial.
Walsh, Thomas E., Haddon Hall.
Ware, C. W., Elec., Penna.
Warne, C. C., First Asst. P. A., N. Y. C., Shelburne.
Warrington, J. Burwell, Asst. Truck Sup., A. C.
Waterfield, D. B., Shop Eng., C. & O., Traymore.
Watrous, Lyman J., Royal Palace.
White, A. K., Marlborough.
White, C. D., Marlborough.
Williamson, C., For. M. P. Dept., C. of N. J., Normandie.
Yearsley, Chas M., For., A. C.
Yoneoka, S., Southern Manchuria, Marlborough.

Conventionalities

George McCormick, general superintendent of motive power, Southern Pacific, is in attendance at the convention for the first time.

The increase in the crowd at the convention was illustrated by the number dancing Wednesday night. It was undoubtedly the largest "first night" crowd in the history of the conventions.

Twenty-eight railroad department salesmen of the American Steel Foundries enjoyed a business family dinner and get-together meeting, at the Marlborough-Blenheim Tuesday evening.

H. E. Passmore, Grip Nut Co., and Mrs. Passmore and their daughter are at the Chalfonte. Miss Passmore is making an extended trip of inspection among schools and libraries in preparation for future work which she intends to take up.

H. T. Bentley, general superintendent of motive power and machinery of the Chicago & North Western, will be able to attend only the first half of the convention. He will sail for England on Saturday and expects to spend a short time there visiting his old friends.

Samuel Higgins, of the United States Railroad Labor Board, formerly superintendent of motive power, Lehigh Valley, later general manager New York, New Haven & Hartford, is at the convention renewing acquaintance among the mechanical officers with whom he was formerly actively associated.

Mr. and Mrs. C. E. Fuller returned from a trip around the world just in time to come to the convention. They are among the best-known visitors, Mr. Fuller, it being hardly necessary to say, having been for years superintendent of motive power of the Union Pacific and one of the most active workers in the mechanical association.

D. S. Murphy is one of the railroad men who have joined the supply fraternity recently and are attending this convention. He resigned as division superintendent of the Missouri-Kansas-Texas Lines at McAlester, Okla., some months ago and is now chief service engineer of the Franklin Railway Supply Company.

Mrs. A. Fenton Walker, United States representative of the Canadian Railway and Marine World, who is attending the convention, expects to sail for England on the S. S. Scythia on the 19th. She will visit her brothers at Pitlochry, Scotland, and will attend the meeting of the Associated Advertising Clubs of the World at London.

From the best information we can secure, Thomas Ausley Allison is the youngest attendant at the conventions this year. He was born April 24 and is seven weeks old. His father, Col. William L. Allison, of the American Arch Company, went to Philadelphia yesterday afternoon to meet Mrs. Allison and the little boy.

Some of the boys who were here early, after a comparison of notes on certain railroad men organized "The Buzz-Saw Club." Its ritual is based on the story of the traveling men in other lines, one of whom spoke of a passer-by in opprobrious terms and said he was the buyer for X. Y. Z. & Co. "Yes, yes," responded the others, "He don't buy nothing from us, neither."

F. N. Bard, who at the time of the convention two years ago was noted as having succeeded his father as president of the Barco Manufacturing Co., is not able to be present this year because he has sent all his available men and somebody had to stay at home to take care of the business and keep the plant in Chicago running.

Mrs. Harold B. Gardner, familiarly known as "Bobby Besler" by the members of the New York Railroad Club, is attending the convention with Mr. Gardner, who is with the Westinghouse Air Brake Company. The son, who is eight months old, is staying with Grandpa Besler, president of the Central Railroad of New Jersey, whose home is at Plainfield, N. J.

The Entertainment Committee, and especially Chairman C. W. Floyd Coffin, are to be congratulated upon the excellence of the dance music that has been provided. Almost everybody dances nowadays, and the music on the Pier is so good that it makes even those who have not been addicted to it feel impelled to begin acquiring the terpsichorean art.

"Dave" Pye, who is spending a lot of his time giving publicity to the New York Railroad Club outing, which is to be held next July, has been receiving condolences from his friends because the *Daily* demoted him. In its item in Thursday morning's *Daily* Dave was mentioned as vice-president of the Tuco Products Corporation. He has been president of that company from its inception and we are pleased to announce still holds that position.

W. H. Harris, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kans., is accompanied by his wife and son, William. The son is a student at the University of Kansas at Lawrence and is preparing to enter Harvard later on and take a medical course. The trip east is in the nature of a reward for the very good record that he has made during the school year which has just closed.

A. L. Humphrey, president of the Westinghouse Air Brake Co., and Locomotive Stoker Co., chairman of the board of the Union Switch & Signal Co., and executive officer of other Westinghouse organizations, is not in attendance during the first week of the conventions on account of being engaged in the more important duty of nominating a President of the United States at Cleveland. Mr. Humphrey is not new to the political game, having been a member of the Colorado legislature when he first appeared at these conventions.

J. C. Clark, formerly with the Union Pacific, and the author of several articles on personal questions which have appeared in the *Railway Age* during the past two years, is attending the convention for the first time. He has just been appointed director of railroad sales of the Kardex Company. This company makes a specialty of visible records and the department which Mr. Clark heads has just been established. His office will be in Tonawanda, N. Y.

George W. Denyven, New England representative of several of the exhibiting companies at the convention, and a member of the Executive Committee of the R. S. M. A., recently returned from an extended trip abroad. He visited Algeria, Egypt, Palestine, Syria, Greece, Paris, the Ruhr, Belgium and England. He and C. W. E. Clarke, of the Dwight P. Robinson Co., had a streak of luck in winning many of the "ship pools" aboard the Majestic on the return passage. Mrs. Denyven is also attending the convention this year.

A. A. Taylor comes to the convention this year as vice-president and general manager of the Locomotive Firebox Company, and John Baker as assistant vice-president of that company. Mr. Taylor formerly was manager of the railroad department of Fairbanks, Morse & Co. Mr. Baker was long chief clerk to W. J. Tollerton, general mechanical superintendent of the Rock Island Lines, and is one of that numerous galaxy of promising young railroad men who are lured into industrial business.

Frank Thomas, supervisor of apprentices on the Santa Fe, is not attending the convention this year, for the very good reason that he is remodeling his home and, in the absence of Mrs. Thomas, must supervise the job and keep the home fires burning. The Santa Fe apprentice department is officially represented at Atlantic City, however, by one of his associates, Robert J. Phelps, apprentice instructor at San Bernardino, Calif. Mr. Phelps is accompanied by Mrs. Phelps.

H. D. Webster, engineer of motive power, Bessemer & Lake Erie, and Mrs. Webster stopped off at Bethlehem, Pa., where their son, Joe, is attending Lehigh University. Joe is taking the course in mechanical engineering and expects to continue post-graduate work in aeronautical engineering. He has just successfully completed his freshman year at Lehigh. Mr. and Mrs. Webster expect to visit friends in New York and East Orange, N. J., before they return to their home in Greenville, Pa.

J. W. Motherwell found it hard to register from Boston, having for years registered at the conventions from Chicago. Soon after the death of A. C. Ashton, treasurer of the Ashton Valve Company, Mr. Motherwell, who was vice-president of the company in Chicago, moved to Boston to become vice-president and general manager, which position he now holds. He is accompanied to the convention by Mrs. Motherwell.

In order to make the most efficient demonstration of pneumatic tools, George Gallinger, Ingersoll Rand Co., brought to the exhibit an air compressor to operate the tools, claiming a better quality air is made by these compressors! Mr. Gallinger has been trying the air in various sections of the country for the last four months, from Florida to Hot Springs and from Los Angeles to Mt. Clemens, in the effort to recover his health. Even now he is partial to easy chairs rather than to tramping the Boardwalk or pier.

A. W. McLaren comes to the convention for the first time as a supply man, being now associated with Vice-President Warren J. Lynch of the American Steel Foundries in New York. In the "good old days" Mr. McLaren was chief clerk to Captain Grammer when the later was vice-president of the New York Central Lines and Mr. Lynch was passenger traffic manager in Chicago. Then Mr. Lynch became a railway supply man and Mr. McLaren became traffic manager of Nelson & Morris & Co., the packers, a position he held until that concern was absorbed by Armour & Co.

The explanation of George Wildin's failure to bring his bat with him came out yesterday morning in a casual conversation. Some time ago his superior officer recommended that he take up golf. Later when he was able regularly to beat not only the boss but the various executive heads of other Westinghouse departments, Mr. Humphrey one day asked him when he found time to play. George replied: "Sundays, holidays and when you are away." Baseball does not require enough clubs and a high degree of versatility demands a bagful.

President Aishton, of the American Railway Association, had to leave yesterday after addressing the Mechanical Division, but will return to address the Purchases and Stores Division on Monday morning. The *Daily* has known Mr. Aishton for many years, and his inability to reach Atlantic City in time to deliver his address to the Mechanical Division Monday caused the first failure by him to keep an appointment that we have ever known or heard of. In fact, nobody ever before knew him to be late in keeping an engagement, unless in case of fire or flood—and in this case it was a flood.

C. H. Quinn, formerly chief electrical engineer, Norfolk & Western, appeared unexpectedly at the convention yesterday, having returned last Monday with Mrs. Quinn on the S. S. Leviathan, after a stay of two months in Paris and vicinity. The Palace Hotel, San Francisco, is now Mr. Quinn's headquarters, and he will leave New York for that destination on next Wednesday. He declares he will not again affiliate himself with railroad work, but it remains for Mr. Quinn to prove whether or not that is possible for one who has for 30 years been so actively engaged in it.

Commissioner Frank McManamy, of the Interstate Commerce Commission, accompanied by Mrs. McManamy, has arrived for the convention. He will be one of the speakers at the session Monday morning. Mr. McManamy has been coming to the conventions in different capacities for years. He came first as assistant and later as chief inspector of locomotives of the commission. Under government control of railways he came as assistant director of the Division of Operation of the Railroad Administration. He was appointed member of the commission by President Harding, and reappointed by President Coolidge.

The man who talks about the unprecedented coldness of the season at Atlantic City either was not present or has forgotten 1906. We were on the Steel Pier that year and in order that the newspaper wheels might not fail to revolve, Hugh M. Wilson, then in charge of the destinies of the *Daily*, sent over into the town and commandeered an oil heater for each of his workers and himself. It may be noted as of passing interest that six stoves were sufficient for the outfit in those days, while today it might be more to the point to corral a whole stove factory. But we kept reasonably warm—in 1906. Moreover, the second week was all right—in 1906.

George E. Howard, Commonwealth Steel Co., has one on the pickle factory. He has a photograph taken in 1883 showing himself in front of his engine, No. 57, of the Union Pacific—one of those old-timers of which the stack was the predominating feature and the boiler a brass-decorated gas pipe. Well, he has a fancy for that number —57—and retains it on the up-to-date gasoline wagon he now drives, all the efforts of pickle men and others to the contrary notwithstanding. It would perhaps be invidious to call attention in this connection to the official of a neighboring state to the one in which Commonwealth Steel Co. has its plant who persistently retained No. 55,555. But he was conspicuous in state politics.

George E. Long, at one time secretary and later first vice-president of the Joseph Dixon Crucible Co., who had for many years been a regular attendant at the mechanical conventions, died about two weeks ago. He retired from active participation in the business about four years ago on account of failing health and had been confined to his home most of the time. He still retained his connection as a director in the company. To his

work is given the credit for the promotion of flake graphite for lubricating purposes and the company's success in promoting its general use for this purpose. He also for many years had the direction of the company's advertising business and for this reason was especially well known among newspaper men.

W. S. Palmer, president and general manager of the Northwestern Pacific, with headquarters at San Francisco, stopped off on his way home from Washington yesterday to see the exhibits. This was his first visit to one of the conventions and he was greatly impressed by the extent and value of the exhibit.

Mrs. B. W. Mudge and Mrs. R. D. Sinclair motored from Chicago to Princeton, N. J., where they were joined by Burton, Sr., who was east on business, and Burton, Jr., who has just completed his junior year at Princeton University. The party then motored to Atlantic City. Burton, Jr., had the misfortune to develop a trouble with his eyes that made it impossible to take his "exams," but hopes to be in condition to take them before the opening of the next college year.

John Nicholson, president of the Locomotive Firebox Co., has been delayed in coming to the convention by an accident to his son, James. The Nicholsons have a stock farm near McHenry, Ill., which is run by James Nicholson. He was operating a tractor gang plow when one of the shares went through his foot. He had to be taken to a hospital in Chicago, where it happened that his wife lay sick at the same time. John Nicholson intended to come on the special train from Chicago, but will now arrive later. Mr. and Mrs. James Nicholson are both getting along satisfactorily.

Ralph S. Cooper, vice-president of the Independent Pneumatic Tool Co., has just returned from a hurried business trip to Europe, arriving on the Olympic yesterday—his seventh trip on that boat. He had a very rough passage and was delayed a day on account of the weather. Mr. Cooper reports very good business on the other side. His company is now doing business with almost all the railways in Great Britain, all of which goes to show that it is not impossible for American concerns to break into the European field. Business conditions seem to be good abroad. The shipyards are busy and France is making great progress in automobile construction. Mr. Cooper is accompanied by his wife, this being her first convention. Mr. Cooper himself has been a regular attendant since 1905.

Among the most interested and closely observant of exhibit visitors on Thursday were Iwao Koyama, resident representative in New York of the Japanese Government Railways; Isamu Saito, M. E., assistant representative of the same, and H. Namba, chief of railway electrification section, Japanese Government Railways. They were accompanied by S. Itow, mechanical engineer, train operation department, South Manchuria Railway, and Mr. Adzuma, mechanical engineer of the same road, both from Dairen, Manchuria. At the time the representative of the *Daily* was able to overtake them they were engaged with the exhibit of the American Steel Foundries and were propounding numerous questions as well as exchanging views with each other on the complete truck which forms a part of the exhibit.

J. A. Kinkead, Parkesburg Iron Co., who is here all the way from California, has an interesting story to tell about business conditions there during the last few months. He tells it in the words of the famous Chap. LXXVII of Horrebow's "History of Iceland." The chapter is headed "Snakes." The whole of the chapter is "There are no snakes of whatever nature in any part of Iceland." The scarcity of business in California is due to the prevalence of the foot and mouth disease and the exaggerated precautions taken to prevent its spread. Cattle were killed by the tens of thousands and buried in trenches dug with a steam shovel. The holding up of passengers at Yuma, on the border of Arizona has been made generally known throughout the daily press. During the worst of the trouble, Mr. Kinkead says, one of the roads that ordinarily took 100 carloads a day from a certain point had its tonnage reduced to absolute zero. But Mr. Kinkead has a more interesting story to tell about his four boys. They are now in Paris learning the French language in the best way and at the best age and are incidentally teaching young Johnny Crapaud to swim.

A casual stroll around the pier discloses several men who at one time or another have labored on the *Daily* in convention work. Harry W. Frost, president Frost Railway Supply Co., of Detroit, for several years did work "in lighter vein" in this department of the *Daily*. F. B. Ernst, American Steel Foundries, for awhile gave attention to exhibits in general as a training for efficiency in representing a single line of equipment. John C. Whitridge, Buckeye Steel Castings Co., as the representative of what was then a rival publication, found the *Daily* to be a more easily available source of material for his report than attendance at all the meetings. George L. Fowler is another of the old-timers who used to do much heavy editorial work. Among more recent graduates from this course of education is A. F. Stuebing, who makes his first appearance this year as chief engineer of the Bradford Corporation. E. A. Averill, formerly of the Railway Mechanical Engineer and therefore available for service on the *Daily* is now representing the Superheater Co. C. N. Winter, managing editor of The Car Builders' and Locomotive Cyclopedias as his primary occupation, who has been at times drafted into the *Daily* service, is at the present convention as representative of the Rogatchoff Co. Andrew C. London is representing the Superheater Co. in Canada; he was active on the *Daily* staff several years ago.

Among the arrivals at the convention yesterday was R. S. Hurd, special agent on the Pennsylvania System and in charge of the motor truck development work which that road has been actively carrying forward during the past year under the general direction of R. C. Wright, general traffic manager. This road has adopted a broad plan for the utilization of motor trucks in railway operation, the basis or main principle of which is the actual co-ordination of rail and motor operation. The scheme does not contemplate the complete taking over of the total traffic on any one line or lines, but only the taking over of that traffic which is primarily truck traffic. The broad plan is really sub-divided into three plans covering consecutively (1) local or peddler train traffic; (2) terminal operation, and, finally, (3) store door delivery. To date only Plan 1 has been put into effect, the first unit being installed on the Eastern division out of Pittsburgh, July 9, 1923. Since that date 21 units have been placed in operation, serving over 1,000 miles of line and covering practically all of the Pennsylvania's lines in the state of New Jersey and those radiating from Philadelphia and Pittsburgh. The work is done on contract, the railroads owning no tracks for this purpose. So successfully has the plan worked that it has not been necessary to make any changes in it since it was inaugurated. Work has already been started on Plan 2, and at the present time the Cleveland terminal of the Pennsylvania is being motorized with the expectation of placing it in operation during the early part of July.

Electrical Engineers Meet at Hotel Dennis

Fourteen Committees Present Progress Reports on Live Subjects at Semi-Annual Convention

The Senior Annual Convention of the Association of Railway Electrical Engineers was called to order at the Hotel Dennis by the president, Ernest Lunn, of the Pullman Company at 10:10 A. M. yesterday morning.

In the opening the meeting Mr. Lunn spoke in part as follows: "It gives me pleasure to welcome you to the meeting and to invite you to listen to the reading of the various progress reports which will be presented and which represent the thoughtful effort of your fellow members who have willingly consented to assume the responsibility of placing before you, and others interested, their latest findings relative to the most up-to-date practice in the subjects covered.

"The progress reports representing, as they do, in each case, not the opinion of an individual, but if a group of men trained to meet the problems presented, should be given your careful consideration, and where criticism is warranted let it be forthcoming and if commendation is justified a little encouragement will do no harm.

"We can look back on some worth-while achievements as an Association and feel hopeful for the future. The successful reports of various committees have covered the respective fields fully and standards recommended have been quite generally adopted."

"The report of the Committee on Data and Information submitted at last fall's convention, showe dthe use of electrical devices to be rapidly increasing on railroads and the discussion which followed its presentation clearly indicated the necessity for alertness on the part of the electrical engineers, whose duty it should be to give not only opinions when asked for, but to initiate improvements, the carrying out of which would be reflected in worth-while economies.

"Our association is somewhat unique in that it includes in its membership not only men of electrical executive training and technical men, but those who have by reason of their thoughtful study and experience in handling equipment qualified themselves to pass intelligent opinions on the many problems which must be faced in railroad work.

"The officers and members of the various committees have our sincere thanks for their unselfish efforts in making this meeting a success."

Immediately following the address of the president, the report of the secretary-treasurer was presented. In view of the short time available, Mr. Andreucetti, the secretary-treasurer, gave a brief verbal statement in which he stated the membership of the association to be 450, and the financial resources to be approximately $3800, with no liabilities.

The committee reports were presented in the following order:

Trucks and Tractors

The Committee on Trucks and Tractors stated its intention of sending out a questionnaire in the near future to the operating heads of the various roads in order to secure data on operating costs of trucks and tractors. A subcommittee, which was appointed to investigate the use of crane type trucks in the roundhouse had not made any report. The general committee was anxious to hear discussion on a large number of questions which were included in the report, these questions being so complete in their scope as to include practically the entire subject of truck and tractor operation.

Discussion

Most of the points of the discussion were a repetition of those which were brought up at the annual convention last fall. The subject of the desirability of larger battery boxes on trucks was discussed at length, the main point of the argument being that a larger box would allow the use of certain types of car lighting batteries to be used for trucks, with the result that a fewer number of spare batteries would be required. In view of the short time the discussion was somewhat curtailed, and in closing the committee made a final appeal for written discussions to be sent in, particularly with regard to the economies that could be effected by the use of trucks and tractors.

Safe Installation and Maintenance of Electrical Equipment

The report of the Committee on the Safe Installation and Maintenance of Electrical Equipment presented its first report, there having been no committee on this particular subject prior to this year. Two general sections were included as is indicated by the title. The part relating to installation was divided into a number of groups giving general specifications on switchboards, power panels or substations, motors and control equipment, and wiring. The section on maintenance was considerably shorter and presented a number of rules to be followed in the inspection and maintenance of electrical equipment.

Discussion

Exception was taken to some of the items in the report on the grounds that the committee had made the limitations too severe, this being particularly true in connection with certain wiring suggestions. A great deal of the discussion centered around the subject of fuses, some perferring the so-called one-time fuse, while others advocated the use of refillable fuses. It was also advocated that the committee showed incorporate in its complete report a description of the prone pressure method of reserscitation from electric shock.

Self-Propelled Cars

The report indicated that there is a growing interest in self-propelled cars of all types. This has been manifested by the installation of a number of cars on various roads. The Canadian National Railway has added six storage battery cars to the number which it already had in service. Two storage battery cars are being put in operation on the Central of Vermont and additional gasoline cars have been installed on a number of eastern roads.

The three developments which are of greatest interest at the present time are a hydraulic transmission as installed on the gasoline car of the N. Y., N. H. & H., a gasoline car with multiple unit control manufactured by the Mack Truck Company, Allentown, Pa., in which a separate gasoline engine is mounted on each truck beneath the car floor and the two engines in each car or the several engines in a multiple unit train are operated by electro-pneumatic control, and a gasoline-

electric car. The third development, the gasoline-electric car, is being built by the Electro Motive Engineering Company, of Cleveland. It has a motor generator set mounted on the floor of the car, the car being driven by motors on the car axles in the usual manner. Considerable interest is also being shown in the development of the Diesel electric car both by the manufacturers and by the railways.

It is the intention of the committee to obtain full information on a test run of each of the battery cars on the Canadian National from which reliable energy consumption records will be available.

Discussion

Several notable examples of recent operation with self-propelled cars were mentioned. One case of a gasoline-electric car on the Lehigh Valley was cited. This particular car was operated approximately 108 miles per day for a year and had been out of service but one day during a year. A careful record was kept of maintenance cost, and it was stated that this particular car was responsible for a saving of $1800 per month in the cost of operation.

Another notable achievement was that of a gasoline-electric car which just completed a trip from Chicago to Atlantic City. This car averaged 38 miles per hour and required not the slightest maintenance throughout the long journey. At some places it was operated at a speed of 60 miles per hour. (An article on this car and its trip to Atlantic City will be found elsewhere in this issue.)

Electric Welding

In view of the fact that electric welding has passed the experimental stage, the Committee on Electric Welding felt that the time had arrived when it was extremely advisable for the Association to compile a manual of electric welding. Such a manual should cover all electric welding processes used in railroad shops, including arc welding with carbon and metallic electrodes, spot welding and resistance welding. The first section of such a book should consist of a description of the various electric welding processes and their general use, and the second section should consist of recommended methods of installation. The third section should consist of recommended methods of application covering first, the typical jobs and important jobs that have already had their successful application demonstrated by years of service, including detailed instructions for the training of operators.

From time to time as better practices are developed and approved, bulletins or new sheets could be issued, the committee feeling that the manual should be of the loose-leaf type.

Discussion

It was felt that the work of preparing such a manual as the committee suggested would be an enormous task, but one which would be very much worth while. It was also suggested that the cost of such work would be considerable, but in view of the excellent financial position of the association it was believed that this expense could be readily taken care of and the committee was authorized to proceed with the preparation of the manual.

Locomotive Electric Lighting

An effort was made by the committee to develop a standard method of making photometric tests of headlight reflectors. The report described in detail three tests made under various conditions. The results indicate that considerable savings may be realized by allowing glass reflectors to go for long periods of time without cleaning; the length of time depends upon the condition of the headlight cases and their ability to exclude dirt.

In the matter of headlight and cab lamps, particularly with the 250-watt lamps, investigation has shown that many lamps fail very early due to inherent weaknesses, including brittle filament material. This results in seriously increasing consumption. In order to learn more about the matter of premature lamp failure, the committee proposes to send out a questionnaire seeking information from the members as to just when the lamps fail.

Recent developments tend to show the possibility of introducing a fixed or permanent focusing device for the headlight. One of the roads is experimenting with the idea on a rather extensive scale and the committee felt that it would be of interest and value if similar tests could be carried on by others. The subject of roller bearings for headlight generator service continued to be given attention and one of the headlight manufacturers has obtained satisfactory results from several installations of this type of bearing.

Discussion—It was felt that further improvements can be effected in improving lamps for locomotive service. Manufacturers, however, have gone about as far as possible in the development of cab lamps until the railroads make use of the improvements which have been devised. A divergence of opinion was shown regarding the possible omission of the focusing device from locomotive headlight reflectors. The opinion was offered that the power supply for train control will come from a power plant on the locomotive and the suggestion was made that the committee study the situation and if possible show ways of providing for this contingency.

Electrical Storekeeping

The Committee on Electrical Storekeeping, another new committee, reported for the first time, and announced its intention to send out a questionnaire to the various roads in order to procure information as to the present practices being followed in maintaining stocks of electrical material and also to secure recommendations for improved practices. The proposed questionnaire formed a part of the report.

Discussion—In the discussion an outline of conditions existing on a number of roads was presented. This showed the importance of assembling the information outlined in the questionnaire which is to be sent out by the committee to signal, telegraph and electrical departments.

Train Lighting Equipment and Practice

The report of the Committee on Train Lighting Equipment and Practice took up the question of changing the design of the present battery boxes, looking toward a deeper box which would make it possible to employ a tank having more sediment space which, in turn, would permit the lengthening of the period between cleanings. Some roads have found that this practice has resulted in a marked saving in the matter of battery maintenance expense. Specific instructions were included in the report for the paraffin treatment of the wooden battery crates. While further particulars will be presented at the annual convention, advance information indicates that this treatment, if properly done, will greatly increase the life of the crates.

The axle generator drive question came in for a small share of attention. Of the barrel type pulleys which have been installed for some time, the 28½ inch pulleys seem to enjoy the preference over the 33½ inch pulleys. A comparatively new type of axle pulley,

known as the universal type, has been installed on 45 cars and it is expected that something more than experimental data will be available in time for the annual convention. A few installations of the silent chain drive are being watched and it may be possible to report favorably, especially on roads which encounter a large amount of snow. It is reported that these chains last about two years or approximately 160,000 miles and that the maintenance cost, considering the positive drive, is not excessive. Consideration is being given to the publication of a working manual of standards covering axle generator construction and accessories.

Discussion—The two subjects which received particular attention in the discussion were battery box height and the development of suitable drive for body hung axle generators. One member on request of the chairman described results obtained with the head-end train lighting system as applied to special conditions. He said that no complaints had been received on suburban trains lighted from a generator located on the locomotive.

Starters and Controllers

The report of the Committee on Starters and Controllers was presented for the first time. It was pointed out that it was not the desire or intention of this committee to draw up specifications for the manufacture of controls, but outline important features that should be incorporated in controls and make recommendations for standard types to be used for various operations in railroad service. It was recommended by the committee that the manufacturer's representative meet with a committee at its next conference and discuss the various features desired in controls. The committee summed up recommendations in a list of 14 items which it felt was desirable to include.

Discussion—An explanation was made by the committee chairman that the report was one which would probably call forth much discussion between railroad and supply men and as the time was limited this was for the time dispensed with. Plans are being made for conferring with manufacturers at the annual meeting to be held at Chicago in October.

Economics of Electrical Appliances

The Association has for some time felt that if various principles of economics were brought to the attention of railway officers a greater appreciation for this part of the work will follow.

It was with this thought in mind that this committee was appointed. The outline of work included a collection of specific data showing economies that have been brought about by utilizing electrical energy for operating railway facilities. The committee presented a tentative questionnaire which was offered as a part of the report.

Discussion—One instance was cited on a certain road where the compressed air supply was so inadequate that an expenditure of thousands of dollars was contemplated to increase the facilities in this direction. On checking over the line it was found that a number of air hammers were responsible for the excessive use of air. These hammers were replaced by electrical equipment, and not only was the amount saved which it had been planned to spend for additional air facilities, but other savings due to this installation of electric equipment were made.

Some objections were raised regarding the difficulty of complying with the request of the committee to supply information concerning direct specific saving due to installation of electrical equipment. On some of the larger roads it was felt that this might be rather burdensome, but it was the opinion of others that inasmuch as estimated savings of any new installation usually accompanied a request for appropriation that this fact could be made use of in furnishing information to the committee.

Sponsor Committee on Insulated Wire and Cables

A verbal report only regarding the work of this committee was presented. There are numerous sub-committees which have in hand the preparation of specifications for rubber-insulated wire of varying quality for various uses; also for silk and cotton-covered magnet wire. The work of the different sub-committees is well under way and in some instances is partially completed, although none of these committees has submitted its report. There was no discussion on this subject.

Committee on Illumination

A verbal report on the subject of illumination was likewise presented. The committee announced its intention to collect information as far as possible in the several fields of railroad lighting, such as yards, shops, stations, round houses, etc., and present this information in such form as to serve as a guide in making similar installations in the future. The programme of the committee, it was estimated, would require several years to complete and as yet the exact form in which it would be presented had not been decided upon. The subject of shop and round house lighting will be taken up this year. In addition to this work changes in lamp sizes and changes in state lighting codes will be incorporated in the committee's report as those changes occur. There was no discussion on this

While it is known that a committee is developing some interesting information on the subject of radio installations on private cars, no written report was presented. An interesting example of what can be accomplished in this direction was cited by the president. A certain car equipped with an eight-tube receiving set was in constant touch with one broadcasting station or another throughout the entire trip from Chicago to Boston. The president requested that the members report to the committee on interesting information in connection with this subject that may come under their observation. No discussion.

Automatic Train Control

No report was presented on the subject of train control, but it was stated that data was being collected, however, and would be in readiness for presentation at the fall meeting of the Association, October 20 to 24, in Chicago.

The meeting adjourned at 2 p. m., bringing to a close the largest attended session that the Association has ever had at its semi-annual convention.
report.

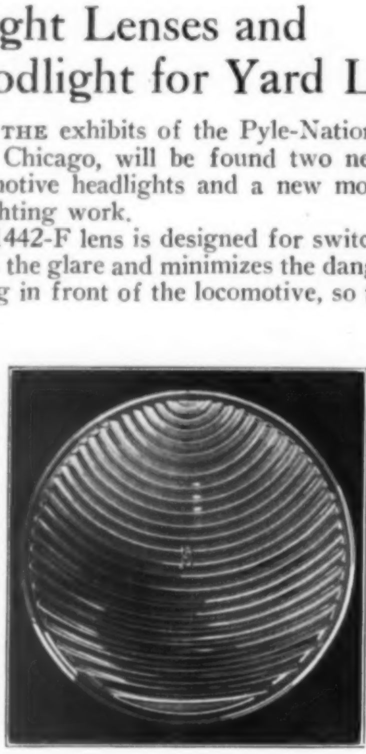
Cars of U. S. Ambulance Train Used in England During the War Being Remodeled for Regular Passenger Service on British Railways

New Devices Among the Exhibits

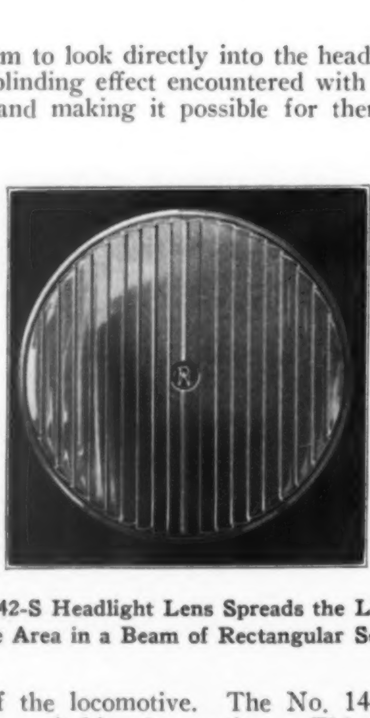
Headlight Lenses and Floodlight for Yard Lighting

Among the exhibits of the Pyle-National Company, Inc., Chicago, will be found two new lenses for locomotive headlights and a new model floodlight for yard lighting work.

The No. 1442-F lens is designed for switch engine use. It eliminates the glare and minimizes the danger to switchmen working in front of the locomotive, so that it is possible for them to look directly into the headlight without any of the blinding effect encountered with the ordinary headlights, and making it possible for them to see the footboard of the locomotive. The No. 1442-S is also employed for switching locomotives. This lens gives a rectangular beam of great spread, covering a large area.



The No. 1442-F Headlight Lens Eliminates the Blinding Effect of Plain Lenses



The No. 1442-S Headlight Lens Spreads the Light Over a Large Area in a Beam of Rectangular Section

The floodlight is made with a body of aluminum-alloy or gray iron, finished in battleship gray or black enamel. All fittings are rustproof plated wrought iron or steel. This light is used with a standard 300 or 500 watt lamp and throws an evenly distributed floodlight of high intensity. The reflector is of non-glare, silver-plated copper or glass.

The Pyle-National Floodlight for Yard Lighting

The mounting is of the swivel base, pilot-house control type. This light occupies a space 9¾ in. by 14¼ in. by 19 in. and weighs 30 lb.

Graphite Packing for Sunbeam Headlight Generator

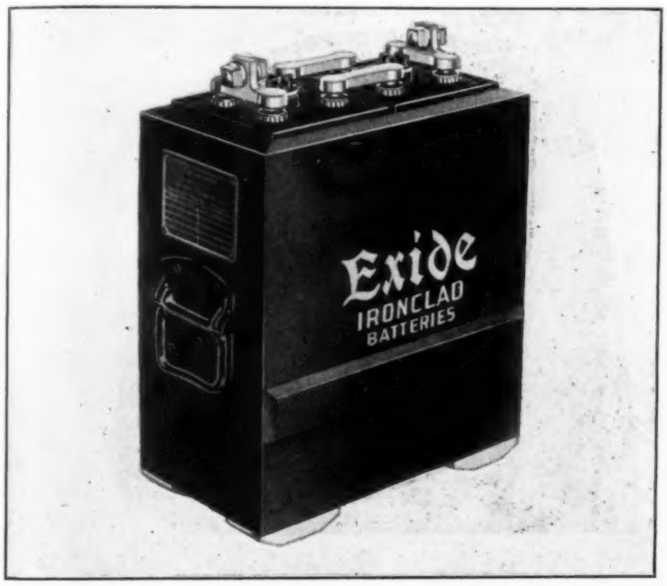
The Sunbeam Electric Manufacturing Company, Indianapolis, Ind., has developed a new type of turbine shaft packing for use on its type RE-3 turbo-generator. In this design the generator shaft carrying the turbine wheel extends from the casing on both sides, making it neccessary to use a packing to prevent steam leaks where the shaft passes through the casing. Their past practice to use a ring type packing but this has proved to be short lived and has caused considerable wear on the turbine shaft..

The new packing consists of a carbon graphite deflector ring, which is mounted on the shaft and enclosed in a loosely fitted housing. The steam pressue on the inside of the turbine casing carries the deflector ring against the face of the deflector cap, making a steam tight joint. Graphite in the deflector ring furnishes sufficient lubrication to prevent any appreciable wear. The deflectors are closely fitted to the turbine shaft with only a few thousandths clearance, so that there is no steam leak along this shaft.

Light Weight Lead Storage Battery for Car Lighting

An Exide Ironclad type of storage battery for car lighting service is being exhibited by the Electric Storage Battery Company, Philadelphia, Pa. The outstanding advantages offered by this type are its comparatively small size and light weight. In addition to this it is a rugged type of battery which will withstand a large amount of rough handling and vibration.

The battery is made up in two-cell units, the two cells being placed in a solid wood tray. The plates are of the Ironclad type and rest on cast ribs in a rubber composition jar. The plate groups or elements are each provided with two terminals which are connected, as shown in the illustration.

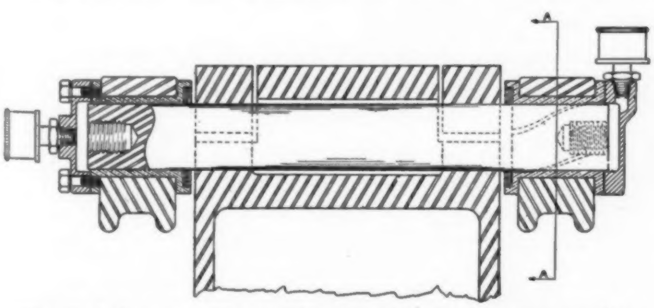


Exide Ironclad Storage Battery for Car Lighting Service

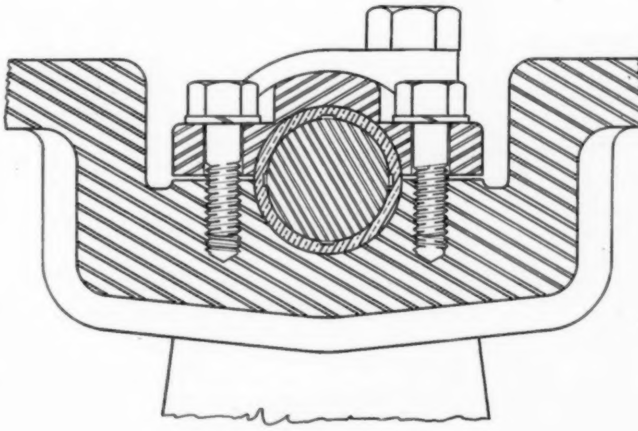
Lighting Generator Suspension Shaft Lubrication

The Safety Car Heating and Lighting Company, New Haven, Conn., is exhibiting a development which provides for improved lubrication of axle lighting generator suspension shafts as well as a better means for removing the shaft when required.

Lubrication of the generator suspension shaft has called for considerable study, because the relative motion between the bearing and the shaft is so small that the lubricant is not carried in by the motion of the shaft and also because the surfaces which need lubrication, that is those which are under pressure, squeeze out whatever lubricant can be introduced instead of building up a film of lubricant between them as they do in a rotating bearing. There is no tendency in a bearing of this kind to heat and sieze but the formation of rust on the surface of the shaft and on the surface of the shaft bushing gradually cements the two together unless all the bearing surfaces are properly lubricated. The new design provides a bearing metal bushing with a series of helical grooves extending around its inside surface, so that all bearing surfaces can be lubricated from these grooves, avoiding the necessity of forcing lubricant between them.



The Lubricant is Distributed by Helical Grooves in the Bushing



Section Thru A-A

The Shaft can be Easily Removed for Repairs

Chiles Trucks for Freight Cars

Among the exhibits at this year's Convention of especial interest to car department officers will be found the Chiles trucks for freight cars, exhibited by J. W. Dalman, Chicago. In the design of this truck the object is to provide increased spring capacity and resilience without additional truck weight. This increase has been secured by the use of a greater number of the present standard A. R. A. Class "D" coils. The introduction of additional springs necessitated a new design of truck side frame and a new bolster end design to provide greater spring bearing area.

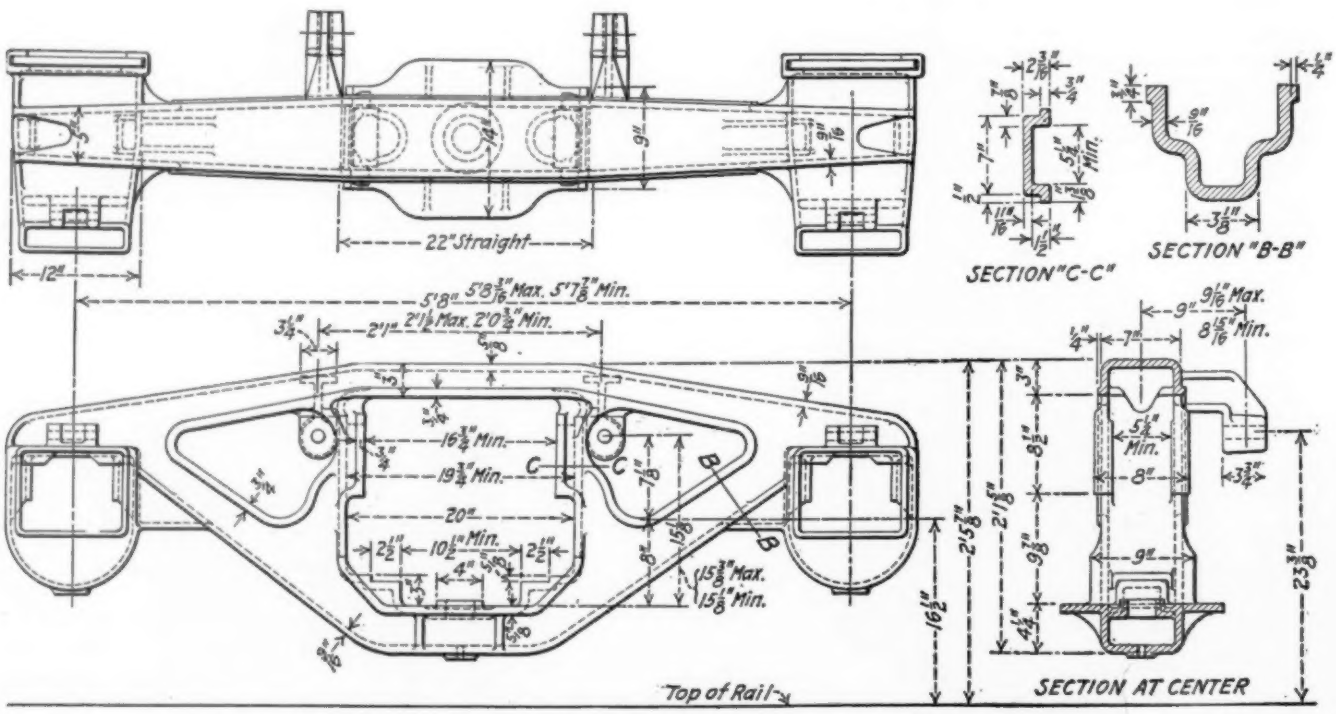
The design of side frame commonly used is neither a truss nor a beam, but a combination of both. Consequently, high and irregular stresses are found at various points in the frame. Such a frame tends to change its form, even when subjected to very low loads, and to take a permanent set at loads much lower than a frame of equal weight built in the form herein described.

The basic principle of the Chiles type of side frames is the use of the form assumed by a flexible cord or chain supported only at the ends and loaded with known weights, distributed exactly as they would be when carrying the weight of the loaded car. The outline of this freely supported flexible member gives the load adjustment which offers the maximum resistance per unit of weight.

When the loaded flexible cord assumes a position of rest, the force line, or line of pull, coincides with the metal line or line of resistance. These two lines are not even approximately coincident in the common design of side frame

and the change of the form under load is its attempt to assume natural lines. A series of tests conducted by Prof. Louis E. Endsley, of the University of Pittsburgh, at the McKees Rocks plant of the Pressed Steel Car Company, showed the high stresses existing in the bottom bar of the conventional type of arch bar truck. These tests were

were approximately on one level. The spring groups on these cars consisted of six standard A. R. A. Class "D" coils; four single outer coils form the central group, while two duoble coils form the outer group, or end springs. This group has a total solid capacity of 82,000 lbs., or 28.1 per cent more than



Suspensicn Line Design and Heavy Sections are Typical of Chiles Side Frames

described in detail in the September, 1923, issue of the Railway Mechanical Engineer.

The number and position of the springs influence the form assumed by the natural suspension line, and the metal line should be located coincident with it or closely approximate it throughout its entire length. The tension member of the frame in the Chiles truck is so proportioned that the metal line coincides with the line of pull, thereby accomplishing a more uniform distribution as well as reducing the stresses throughout the length of the tension member. Subsequent tests of Chiles side frames proved the correctness of this theory in design and brought out the fact that this type of side frame possesses unusual fatigue resistance.

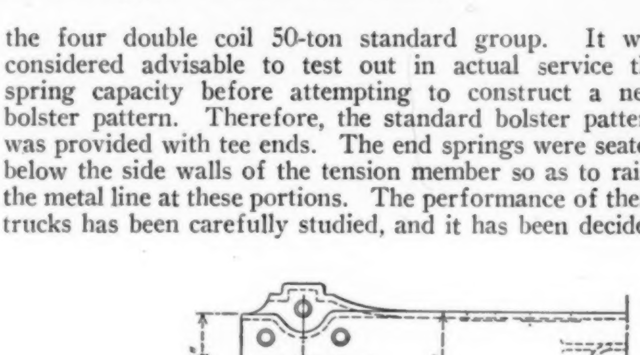
To overcome the trouble being experienced by railroads due to the great number of spring failures, Chiles trucks have been designed to provide increased spring capacity and resilience to the extent of 39 per cent for 50-ton cars and 40 per cent for 70-ton cars.

It is possible to increase the spring capacity and spring resilience of the present standard design of trucks by the use of additional standard coils, but, were this attempted, it would result in a considerable increase in weight over that of the present truck. Taking this into consideration, it is noteworthy that in the Chiles design of trucks provision is made for 40 per cent increased spring capacity and resilience, and at the same time a saving in truck weight is effected.

The function of load-carrying springs is to provide resilience. This is a product of spring capacity and spring travel, and any reduction in the total spring travel will naturally decrease the resilience, thus, in a measure, defeating the purpose for which the springs were provided.

In ten cars equipped with the Chiles design of trucks which have been in service some two years, the springs

the four double coil 50-ton standard group. It was considered advisable to test out in actual service the spring capacity before attempting to construct a new bolster pattern. Therefore, the standard bolster pattern was provided with tee ends. The end springs were seated below the side walls of the tension member so as to raise the metal line at these portions. The performance of these trucks has been carefully studied, and it has been decided



Bolster End Design Showing Provision for Greater Number of Springs

that best results can be obtained by the use of four double Class "D" springs in the central group with single outer "D" bars in the elevated end springs. This group, composed of standard coils, has, when solid, a capacity of 89,000 lbs., or 39 per cent greater than the standard 50-ton

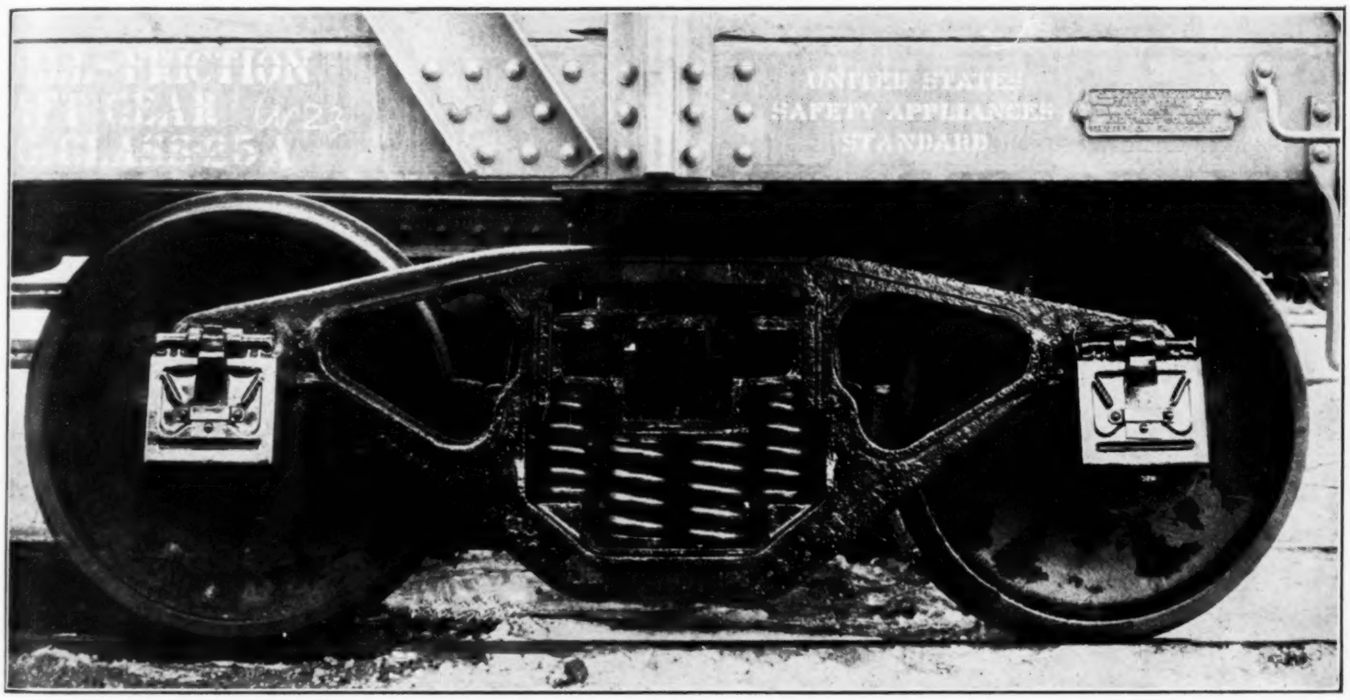
group. This spring group has been used in trucks recently placed in service.

The improved truck has demonstrated that the wider spacing of the springs, together with their greater capacity, has reduced column wear and the tendency of the bolster to tilt.

The elevated end springs, with bolster spring seats on two levels, gives a greater depth to the central portion of the bolster. Two vertical walls extend from the upper spring level to the top wall of the bolster to stiffen the spring seat. The column wearing surface is secured by widening the bearing surface, and the wearing surface is on two planes. In the ordinary bolster the column lugs extend out beyond the side walls of the bolster proper and serve but a single function. In the improved bolster design this transverse wearing surface is secured without projecting the bolster beyond the width necessary for the spring-bearing area.

Table I shows the result of an attempt to increase the spring capacity of the present trucks on 70-ton capacity cars by the use of six double coils of the A. R. A. "D" group. This gives an increase in spring capacity of only 20 per cent over the total spring capacity of the 70-ton capacity car in the second line of Table I. With this spring arrangement, a load equal to the total capacity of the axles requires 52.1 per cent of the total spring capacity, leaving a surplus of 47.9 per cent.

With the Chiles truck design for 50-ton and 70-ton capacity cars, total load, equal to the axle capacity of the 50-ton car requires only 44.9 per cent of the total spring capacity, leaving 55.1 per cent of the spring capacity as a reserve against shocks, vibrations, etc. The total spring capacity of 356,000 lbs. on 50-ton car trucks is an increase of 39 per cent over the total spring capacity of the 50-ton car trucks of the present arch bar design.



The Chiles Increased Spring Capacity Truck for Freight Cars

These features provide a stronger bolster end construction with a decrease in weight. While this increase in spring capacity of 39 per cent has been secured by using the same spring plank used with the four-coil, 50-ton "D" group, a saving in truck weight of some 300 lbs. over the standard truck has resulted.

Reference to the following tables will make clear a comparison between the present conventional type of arch bar truck and the Chiles increased spring capacity trucks:

TABLE I—SPRING CAPACITY OF CONVENTIONAL TYPE TRUCKS

Type of car	Total axle capacity	Total spring capacity	Spring group	No. of springs
50 tons capacity	160,000	256,000	"D"	4 double coils
70 tons capacity	200,000	320,000	"H"	5 double coils
70 tons capacity	200,000	384,000	"D"	6 double coils

TABLE II—SPRING CAPACITY OF CHILES TRUCKS

Type of car	Total axle capacity	Total spring capacity	Spring group	No. of springs
50 tons capacity	160,000	356,000	"D"	4 double coils 2 single coils
70 tons capacity	200,000	448,000	"H"	7 double coils

With conventional truck designs on both the 50-ton and 70-ton capacity cars a load equal to the capacity of the four axles requires 62.5 per cent of the total spring capacity, and when carrying such a load the springs would have a remaining capacity of only 37.5 per cent. The third line in

A total load equal to the axle capacity on the 70-ton cars requires 44.6 per cent of the total spring capacity, leaving in reserve 55.4 per cent. The total spring capacity of the 70-ton car truck of the Chiles design is an increase of 40 per cent ovr the total spring capacity of the 70-ton car truck shown in the second line of Table I.

In this article trucks for two spring arrangements have been discussed; the four spring for 50-ton capacity cars, the six spring for 50-ton capacity equipment and seven spring for 70-ton capacity cars. The saving in truck weight is clearly shown by the following comparison, based on the U. S. R. A. design of the same capacity.

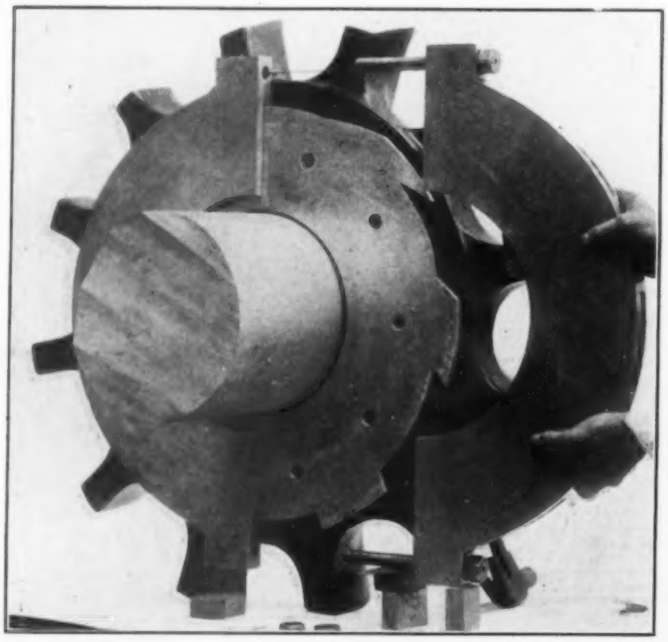
WEIGHT OF SIDE FRAMES AND BOLSTERS PER CAR

A. R. A. "D" coils per group	Capacity tons	Ordinary design	Chiles design	Saving in Weight
4	40	3,320 lb.	3,080	240
4	50	3,710 lb.	3,320	390
6	50	(no design)	3,500	
5	70	4,890 lb.		
7	70	(no design)	4,400	

In considering these comparisons it should be borne in mind that one of the Chiles 50-ton capacity trucks listed and also the 70-ton capacity truck have an increased spring capacity and spring resilience of 29 and 40 per cent respectively over that provided in the ordinary design.

The Badeker Hub Liner

A HUB LINER designed for the rapid adjustment of the lateral motion on locomotives without the necessity of dropping the wheels is being exhibited by the Badeker Manufacturing Company, Chicago. It consists of a split steel driving plate which is bolted on and remains a part of the wheel, about which a brass liner is bolted.



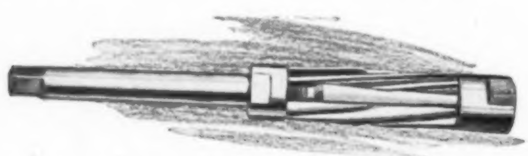
An Interchangeable Hub Liner Which Fits Any Standard Size Axle

The illustration shows that the steel hub liner plate has driving projections that fit into recesses in the split brass outer liner. When this liner is pulled over the plate the whole becomes practically one piece.

It has been demonstrated that this liner can be removed and a new one applied in an hour by one man. The liners are interchangeable and fit any standard size axle. They are made of tough bearing metal.

Spiral Fluted Expansion Reamer

THE SCULLY STEEL & IRON COMPANY, Chicago, is exhibiting a spiral fluted expansion reamer suitable for general service in railroad shops. In this reamer the knives are held rigidly in a tapered vee-block



The Scully General Service Expansion Reamer

with a solid backing. To obtain adjustment or expansion, the blades slide back and forth in the vee-block. The expansion is uniform over the entire length of the blades. The two adjustment nuts hold the blades firmly in place. One turn of the expansion nut increases the diameter of the reamer .005 in.

The detachable taper bushing or pilot is an important feature of the reamer. By means of this bushing the holes are reamed accurately and straight, which insures perfect alinement. The reamer can be furnished in sizes of from 5/8 in. to 1 1/2 in., inclusive, permitting expansion up to .05 in.

High Pressure Lubricator

THE CARR FASTENER COMPANY, Boston, Mass., is exhibiting the Dot pressure lubricating system for locomotive use, which is an adaptation of the grease gun method heretofore successfully used for the lubrication of many types of bearings. The Dot lubricator will force any lubricant from kerosene to heavy grease into bearings at a pressure of 3,000 lb. and can be operated with one hand.

The Dot Lubricator Is Applicable to Inaccessible Parts

This system has been applied on several roads to locomotive stokers and has proved especially desirable in substituting grease for oil on stoker engine bearings where previously it was possible for steam pressure to blow all the oil out of gravity-feed oil pipes. The application of the Dot system with ball check nipples has simplified the lubrication problems on bearings subjected to these conditions.

Special nipples, spot welded on side rods and applied to hub liners, have made it possible to utilize this system for the lubrication of these parts at a saving in time over former methods as well as with the assurance that the heavy grease will be forced into all parts of the bearing.